Vol. II MAY, 1916 No. 5

Mutilated

The INTERNATIONAL JOURNAL OF ORTHODONTIA

251
309
371

A Monthly Journal Devoted to the Advancement of the Science of Orthodontia

MARTIN DEWEY, D.D.S., M.D., Kansas City, Mo.
Editor-in-Chief

H. C. POLLOCK, D.D.S., St. Louis, Mo.
Associate Editor

J. D. McCOY, D.D.S., Los Angeles, Calif.
Editor, Department of Dental and Oral Radiography

PUBLISHED BY
THE C. V. MOSBY COMPANY
SAINT LOUIS

$3.00 Per Annum Single Copies, 30 Cents

Copyright, 1916, by The C. V. Mosby Company.

LISTERINE

Listerine is an efficient, non-poisonous, unirritating antiseptic solution, especially adapted to the requirements of

DENTAL PRACTICE

A few professional opinions respecting Listerine, of more than a quarter of a century ago; confirmed by its continued use and the lapse of time:

"Particularly noteworthy is the rapidity with which Listerine acts upon the fungi of the mouth. It appears to be one of the strongest and safest of the available antiseptic solutions."
W. D. Miller, A.B., Ph.D., D.D.S.

"I am using Listerine with constantly increasing satisfaction in carious teeth, for dressing operative wounds in the mouth, as an injection into alveolar abscesses, as a gargle in ulcerative sore throat, and as a mouth wash after extraction of teeth."
W. C. Barrett, M.D., M.D.S.

"It is now generally believed that dental caries is caused by acids generated in the mouth by fermentation, and since it is highly probable that a tooth kept absolutely clean never would decay, I have been led to prescribe Listerine for daily use as a mouth wash for patients whose teeth are predisposed to caries."
H. A. Smith, D.D.S.

"As a mouth wash for every day use Listerine surpasses anything I have found for the purpose, and my patients have learned how to appreciate it."
C. E. Francis, D.D.S., M.D.S.

"Listerine is recognized as a standard and reliable antiseptic in many pathological conditions of the mouth."
James Truman, D.D.S.

The following booklets are free, in lots not exceeding 200 copies of each, dentist's name and address imprinted on cover when desired: "The Dentist's Patient," a leaflet on the teeth and their care, suitable for adult patients; "General D. K. Germ, the Enemy of Your Teeth," an instructive and amusingly illustrated tooth talk to children.

Lambert Pharmacal Company
2101 Locust Street St. Louis, Mo.

The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. II ST. LOUIS, MAY, 1916 NO. 5

ORIGINAL ARTICLES

ORTHODONTIC ENGINEERING

BY FREDERICK LESTER STANTON, D.D.S.,
NEW YORK CITY, N. Y.

LAST summer at the International Congress at San Francisco, the author presented a paper describing a dental surveying apparatus which would map the dental apparatus in three dimensions. For a better understanding of the matter that will follow, the underlying principles of this instrument and its use will be briefly described.

It occurred to the author that the problem of malocclusion could best be studied by transferring the points of interest on the teeth, gums and palate, from an accurate model of the mouth to a drawing plane. This is easily accomplished by using the dental surveying apparatus.

The principle used is that of orthographic projections which consist of transferring all points of interest in straight parallel lines vertically to the projecting plane. This form of projection is the simplest used in surveying.

Fig. 1 will illustrate the principle of orthographic projection and will also illustrate the difference between orthographic projections and perspective.

Figs. 2-*A* and 2-*B* illustrate the dental surveying apparatus and how orthographic projections are accomplished by its use. The holder (1) contains the papers on which the map is made and represents the projecting plane. The model is strapped on the surveying base (*D*). The surveying apparatus proper (*C*) is movable and the shaft is perpendicular to the platform on which it moves, and this platform is parallel to the paper in the holder (1).

The surveying point (13) and the projecting point (14) being on the movable arms (7 and 8) which constitute a parallelogram, the straight line joining them is always perpendicular to the drawing plane; and as they are moved up and down by wheel (12), this line remains perpendicular to the drawing plane in all positions. The movable part of the surveying apparatus is moved towards the model, and each point to be surveyed is touched by the surveying

point, the final adjustment being made by the millimeter wheel (12). When lever (17) is depressed, the projecting point makes an imprint on the papers in the holder, and as indicated by the dotted line in the drawing, the point touched by the surveying point (13) is transferred by orthographic projection to the papers in the holder. By this means the two horizontal dimensions are taken care of. The vertical curvature of the dental apparatus involves the third dimension—i.e., up-and-down positions, or elevations, of the teeth. These elevations are recorded in the following manner:

At the time each point is projected, its relative height is recorded on a scale which is on the upper surface of the wheel (12). A suitable card, upon which are recorded all the points of interest to be surveyed, is shown in Fig. 3. On this card are convenient boxes connecting the points surveyed. At the

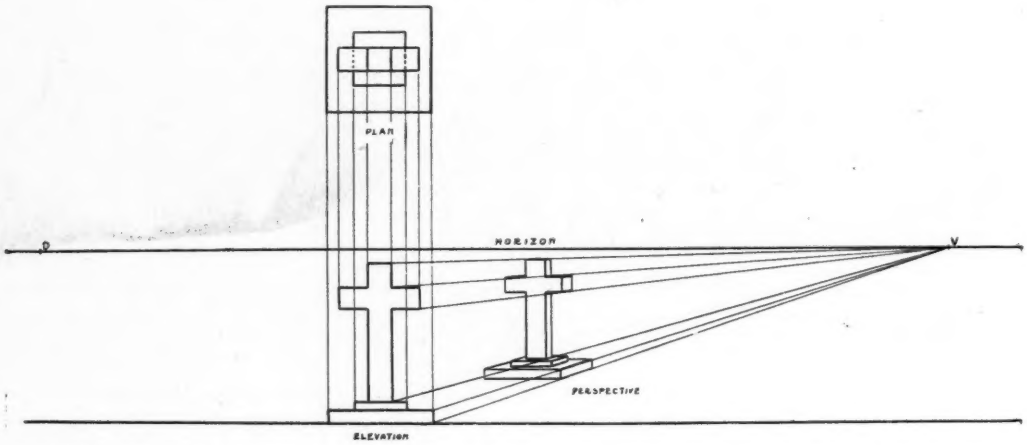


Fig. 1.—Plan and elevation are orthographic projections. Perspective is correct when eye is directly opposite vanishing point *V* and at distance *VD* therefrom.

time of projecting the mesio-buccal cusp of the upper right first molar, its elevation is noted on the wheel as 220 and this number is jotted down in the box as noted in the figure.

The author having succeeded, by means of this apparatus, in transferring to the drawing board, teeth in malocclusion, for study and measurement, there occurred to him the possibility of determining the correct occlusion of any individual from the data in hand, and from these data to make a map of the teeth in occlusion; the map of occlusion would be so arranged in relation to the crooked teeth on the map of malocclusion, that the position selected would require the least tooth movement to change the teeth from malocclusion to occlusion.

In considering bodies in three dimensions, the most convenient method of determining their position in space is to assume three fixed axes at right angles to each other. Movements of bodies are best described by giving a description of the movement in relation to these three fixed axes.

Movements are classified first as translations (bodily movements) in which all points of a body move in the same direction in relation to the fixed axes. The second kind of movement is rotation. In this movement all points in the body revolve simultaneously about a common axis of rotation, which axis can

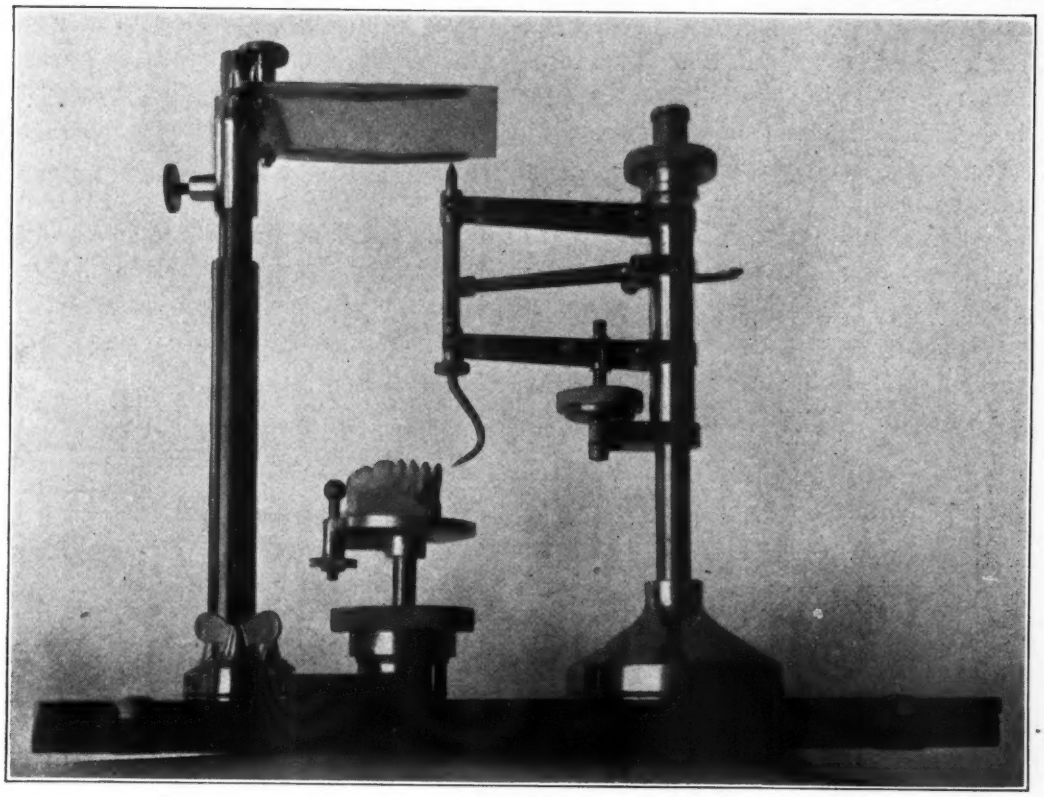


Fig. 2-*A*.

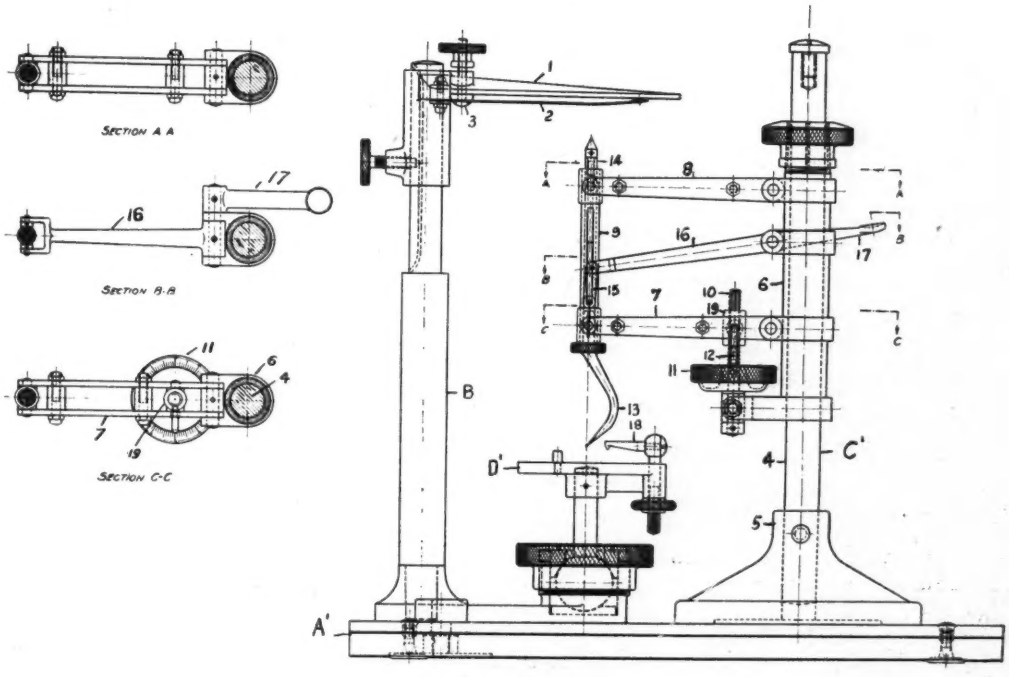


Fig. 2-*B*.

be defined in relation to the fixed axes. With this in mind, it is seen that a position of a tooth can best be described by assuming three fixed axes at right angles to each other; in this way a tooth can be located in space, and any change in its position in malocclusion can then be accurately described by stating its bodily displacement (or translation), or its rotation in relation to these three axes, or the combination of bodily displacement and rotation. If the reader will turn to the latest edition of Angle,* he will find:

"A definite nomenclature is as necessary in orthodontia as in anatomy. The vagueness of descriptive terms often used renders them very inadequate. The terms for describing the various malpositions should be so precise as to convey at once a clear idea of the nature of the malocclusion to be corrected. The

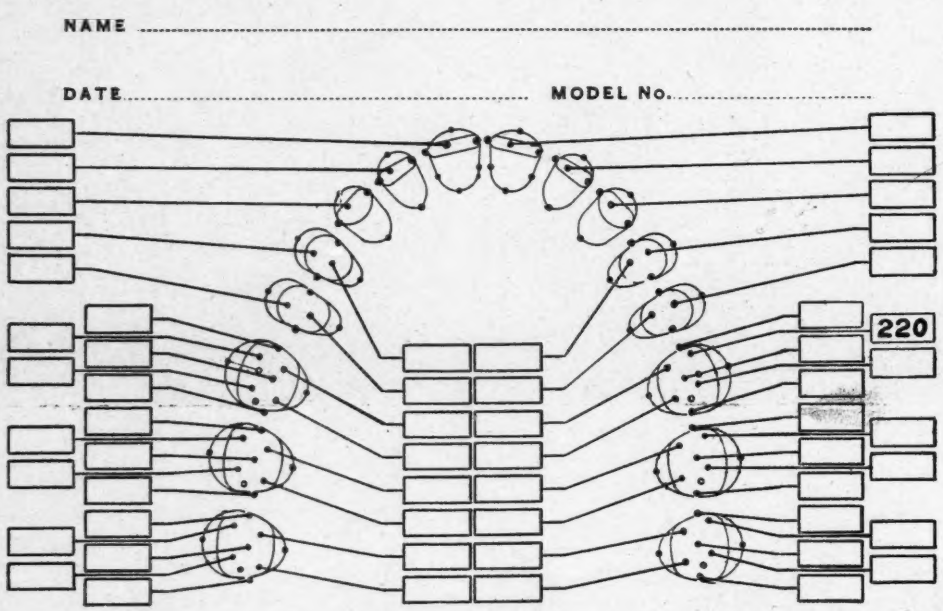


Fig. 3.

author therefore suggests the following, which, while perhaps not perfect, still seems to be a great improvement on common usage."

"For example, a tooth outside the line of occlusion may be said to be in buccal or labial occlusion; when inside this line, in lingual occlusion; if farther forward, or mesial, than normal, in mesial occlusion; if in the opposite direction, in distal occlusion; if turned on its axis, it would be in torso-occlusion. Teeth not sufficiently elevated in their sockets would be in infra-occlusion, and those that occupy positions of too great elevation, in supra-occlusion."

These ideas run through the writings of orthodontists very generally at the present time, and it is easily seen how inadequate such a classification is. This lack of conception on the part of this author (Angle) of the method of determining positions of bodies in space, has resulted in the greatest confusion in orthodontic descriptions. This author in attempting to describe the form of the dental arch, has sought to do so by describing positions of teeth in relation to a line—the line of occlusion. In his extensive work the student is told that the

*"Treatment of Malocclusion of the Teeth," 7th ed., p. 24.

basis of orthodontia is occlusion, that a full conception of the meaning of the line of occlusion must be known and appreciated, and that all deviation of tooth positions in malocclusion must be measured in relation to the line of occlusion. The possibility of an orthodontist understanding this line is discussed by Angle as follows:

"This line (the line of occlusion) describes more or less of a parabolic curve, and varies within the limits of the normal according to the race, type, temperament, etc., of the individual. It is difficult to determine exactly what the form of this line should be in each given case."

The student is told that occlusion is the goal, but no inkling is given by this author as to how he determines a line of occlusion for any individual.

It is suggested that the customary method of defining the positions and movements of bodies in space, be applied to the positions and movements of the teeth. Three axes are assumed at right angles to one another; the position and movement of a tooth may be completely defined with respect to these axes. The most convenient axes to which to refer a tooth, are the mesio-distal axis (joining the mesial and distal contact points), the buccal-lingual axis (joining the buccal and lingual surfaces of the tooth), and a so-called vertical axis, passing at right angles to the other two axes through their point of intersection.

We will now attempt to show in a practical way the application of these principles (see Fig. 4-*A, B, C, D*).

The upper model is placed on the surveying apparatus. It is obvious from observing the side view of this model that there is a considerable disturbance of the vertical curvature of this dental apparatus. Most models, when the teeth are in occlusion, if placed with the occlusal edges of the teeth toward a flat surface, will be very nearly on a plane from the incisors to the first molar. From that point the upper molars tip up in a gentle curve. In placing this model on the dental surveying apparatus, we assume a plane for projecting that takes into account as nearly as possible this distortion of the vertical curvature. Having done this, the points are projected by means of the dental surveying apparatus. Figs. 5-*A* and *B* are maps of the upper and lower models. Before the upper model is removed from the surveying apparatus the lower model is placed in its correct relation to the upper. With the surveying point at a convenient height to touch the lower model, two points at the left heel of the lower model are marked and projected to the upper map without changing the elevation of the surveying point. A similar point is projected from the right heel of the lower model and a point on the same plane on the front of the lower model. The upper model and the maps of the upper teeth are then removed from the apparatus. The lower model is placed on the surveying table and by means of the levelling device the four points, three on the back and one on the front of the lower model, are brought into the same plane. By this means the lower model occupies a plane similar to the one used for the upper model. Fresh charts having been placed in the holder, three registration points are projected to the lower chart. The upper model is placed in occlusion and several gum points of the upper model are also projected to the lower map to be used later for registration points.

In order to determine the occlusal relations of the teeth of the upper and lower model, the points of interest of the lower teeth and gums are now pro-

jected to the lower map. The work of the dental surveying apparatus has been completed. All that this instrument is designed to do, is to project orthographically the dental apparatus, and by means of the elevation wheel, to record the elevations of the various points. This explanation is made because the purpose of this instrument has occasionally been misunderstood; it has been thought by some that it was intended not only to survey the positions of the teeth, but also to determine the positions to which they should be moved in order to estab-

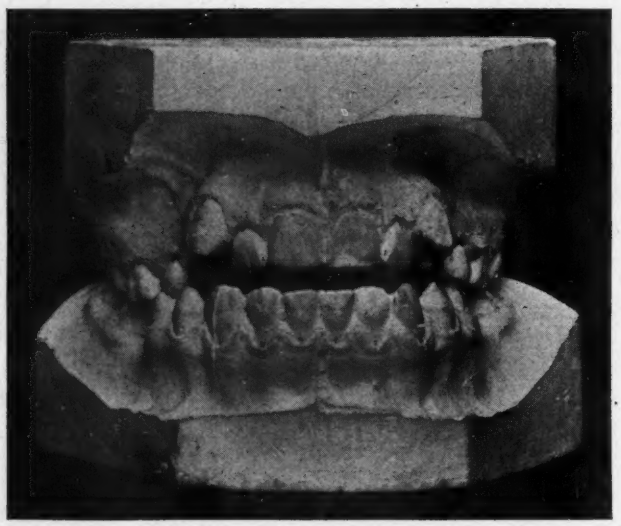


Fig. 4-*A*.

Fig. 4-*B*.

lish occlusion. The dental surveyor is simply a surveying apparatus, and its work should be judged purely from the standpoint as to whether it will or will not orthographically project the dental apparatus and by means of its millimeter wheel, accurately record the elevations of the points surveyed. The maps made by the dental surveyor can now be used for measurements or for testing the symmetry of the dental apparatus.

The author believes from the data obtained, that it is possible to predeter-

mine in three dimensions, the correct occlusion (if the sizes and forms of the teeth of an individual permit of occlusion). This can be done in one of two ways: The occlusion can be determined by a mathematical calculation or it can be determined mechanically by some instrument.

In order that the reader may understand what is meant by determining an arch mathematically, the author would state that he has no method in mind such as the Bonwill triangle or methods similar to the Hawley chart, by which assumption is made on his part that the dental apparatus is of definite form and

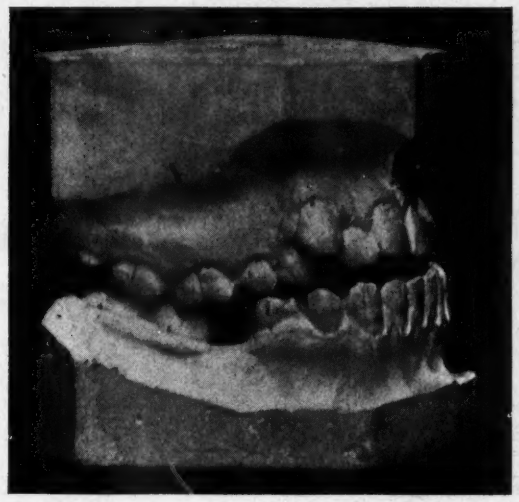
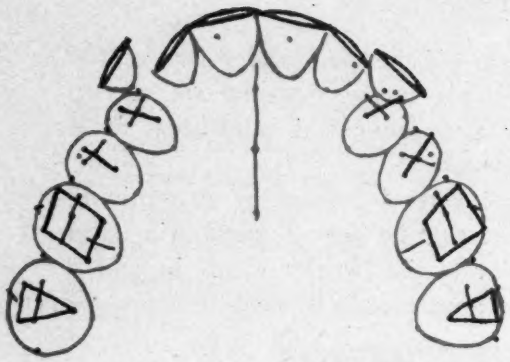


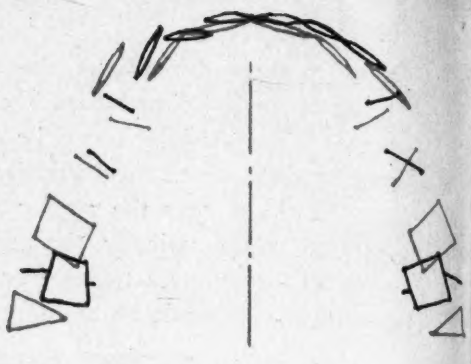
Fig. 4-*C*.

Fig. 4-*D*.

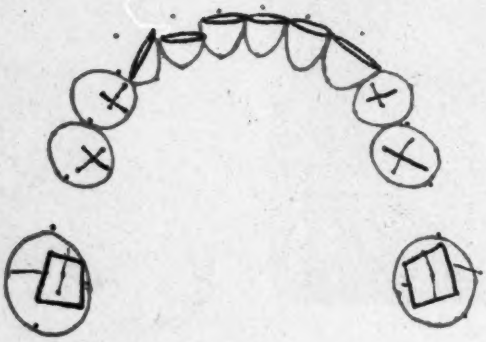
correlated to measurements of certain parts of the teeth or body. His contention is that it is possible to take accurate measurements of teeth and then by mathematical calculations, take these teeth and place them in such relations that they will perform the functions of occlusion or the mutual mechanical relations of the anthropologist. He does not mean that the resultant arch will be, as Angle says, "more or less parabolic," or as Black says, "an ellipse." What the author intends to convey is this; that if the teeth of any individual should be extracted and tooth by tooth should be rearranged in wax in the best pos-



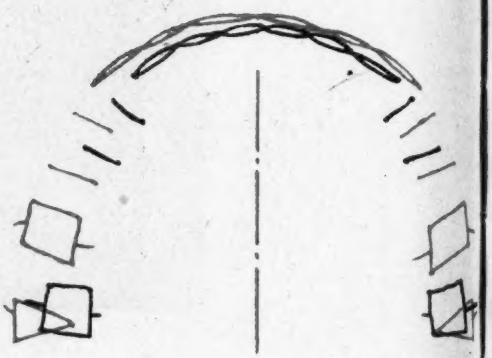
A



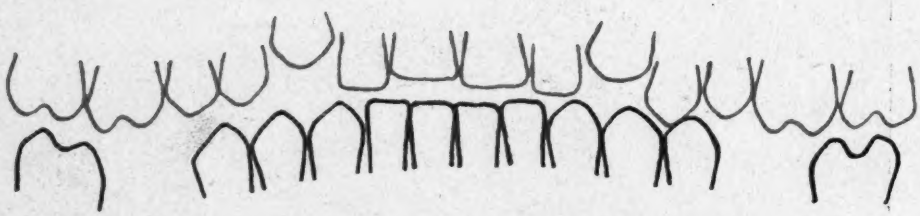
C



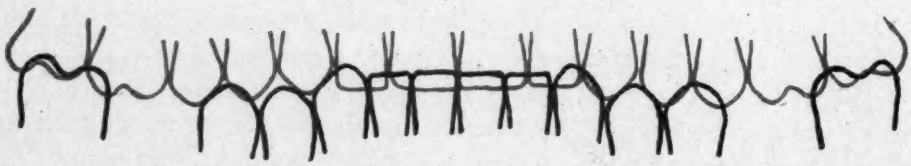
B



D

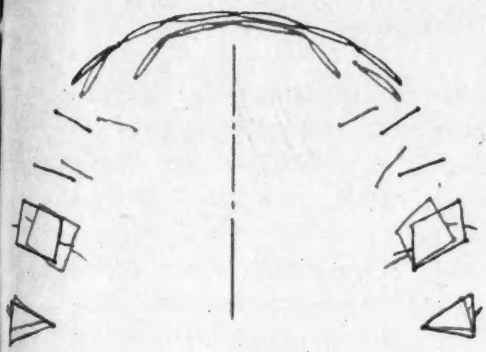


I

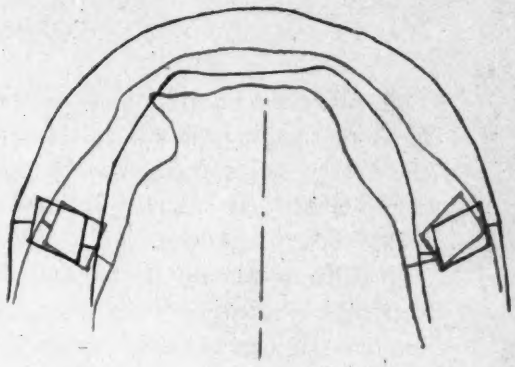


J

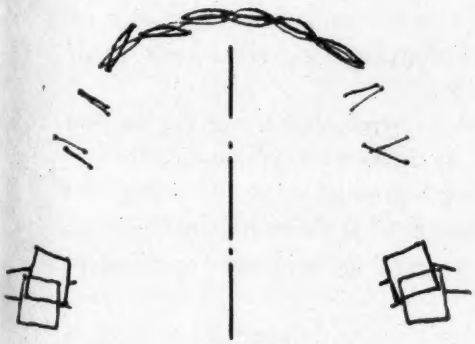
Fig. 5-*A*.



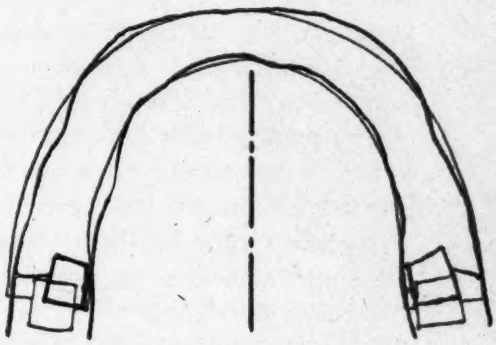
E



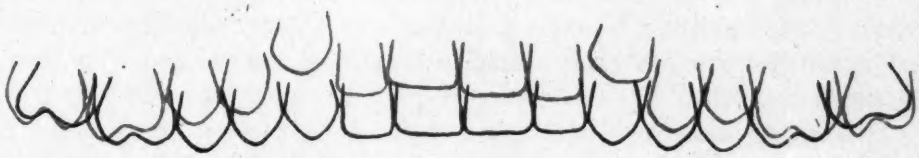
G



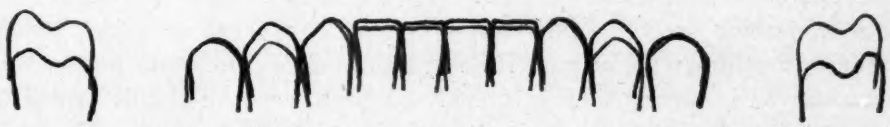
F



H



K



L

Fig. 5-*B*.

sible manner to produce all of the positions of the normal arrangement of the teeth of that individual, that the positions of these teeth when rearranged into the best possible form, can be determined on the drawing board as readily as if the teeth were actually in hand, and that this plan of the teeth can be graphically shown on paper.

If force should be applied to dental arches in normal occlusion and the vertical curvature remain unchanged, the cusps of the lower teeth would slide into mesial occlusion if the arches were widened, and if narrowed, the cusps of the lower teeth would slide into distal occlusion. If an arch should be designed too narrow, the occlusion could apparently be improved by increasing the compensating curve, and if the arches are made too broad, in order to approach occlusion, it would be necessary to flatten the compensating curve.

In a later communication, the author hopes to take up the subject of the vertical curvature of the teeth, but mention is made of it at this time simply to get the fact before the profession that the size and form of each dental arch of each individual is dependent upon the interrelation of the sizes and forms of the teeth of that individual.

In a paper which the author read before the International Congress at San Francisco, an outline of the various arch forms considered mathematically was presented. Since the writing of that paper, a new method of determining the arch mechanically has been perfected and by means of an instrument (the Occlusograph), the arch of any individual can be determined without resorting to mathematical calculations.

Fig. 4 shows a model of malocclusion. In this we will note the great disturbance not only of the vertical curvature of the teeth, but also in the horizontal plane, especially of the upper jaw.

Fig. 5 shows the maps made by the dental surveying apparatus (*A*, upper —*B*, lower). The registration points permit us to place the upper over the lower in proper position, and as the upper is on transparent paper, we can see the exact relation existing between the upper and lower teeth. These maps are placed under the precision-pantograph and enlarged ten times. The relations of the upper and lower jaw are shown in (*C*), the upper, red, the lower, black. The occlusograph designs the occlusion of this individual and stamps the position of the teeth as shown in (*D*)—upper in red, lower in black. The map of occlusion is then placed over the map of malocclusion and a position selected requiring the least tooth movement to change the teeth in malocclusion to their proper position in occlusion. The following figures are transferred from this map by means of the pantograph:

In (*E*) we have the upper teeth in malocclusion in red and their proposed positions in green, indicating the movement of every tooth to produce occlusion. The same is done with the lower jaw. In (*F*) teeth in malocclusion are shown in black and their proposed positions in green. In (*G*) we have the survey of the outer and inner upper gum lines in red, and the new gum lines when the teeth are moved into occlusion, in green. In (*H*) we have the deformed lower gum lines in black and the proposed gum lines in green.

We will now consider the vertical curvature of the teeth and for this purpose we make a horizontal line on transparent paper and intersect it by a straight

vertical line which we will consider the center of the mouth. From this center we lay off on the horizontal line the widths of the teeth, starting with the central incisor (right and left). For the upper teeth we draw above the line, vertical lines representing graphically the widths of the teeth. Below the line we lay off the widths of the lower teeth, drawing lines downward representing the lower teeth. In this way we will have stretched out the dental apparatus and will have shown the teeth in their correct widths, but they will not occlude. At the time the teeth were surveyed, the elevations at all points were noted.

Starting with the central incisor, we know that the elevation of its incisal edge is 261 and of its contacts 270 and 280. These three elevations are laid off on the drawing board at points *A, B* and *C,* and the tooth outline is drawn. All teeth of both jaws are similarly drawn and we have before us the dental apparatus in the third dimension. On a transparent paper of similar size, the widths of the teeth are laid off as before. Then the teeth are rearranged in their correct vertical curvature by means of the following plan:

It has been noted that the contacts of the upper jaw from the center incisor to the upper molar lie very nearly in a plane; hence the teeth are drawn in with their contacts on a plane, and commencing at the first molar, a gentle upward curvature is given. In the horizontal elevation, it is seen in this case that the arches can be formed with the usual overbite, wherefore the lower incisors are allowed to pass the uppers as shown in the drawing, and the lower bicuspids are allowed to pass the cusps of the upper to the depth of the fossæ. Having obtained this map of the correct vertical curvature of the denture, it is then moved about over the map of malocclusion and the same process is carried out as in the case of the horizontal projection; that is, the position is selected that requires the least tooth movement to change the teeth from malocclusion to occlusion.

In (*I*) is shown the denture in malocclusion, the upper in red and the lower in black; in (*J*) is shown the normal vertical curvature of the denture, the upper in red and the lower in black. In (*K*) is shown the incorrect vertical curvature of the upper denture in red, and the necessary movement is indicated by showing the correct position in green. (*L*) treats the lower jaw in a similar way, the incorrect positions in black and the correct positions in green.

Relation of the Teeth to the Eyes

SEVERAL cases are reported by Dr. Wm. E. Bruner, Cleveland, O., showing different types of ocular inflammation caused by diseased teeth with the result obtained by dental treatment. The absence of symptoms referable to the teeth is no assurance that the teeth are normal and are not the cause of the eye trouble, as in several of the most obstinate cases reported the patients thought their teeth were in good condition and had them regularly attended to by a supposedly competent dentist. An x-ray of the teeth will reveal the difficulty, and is the most satisfactory and often the only readily available method of detecting an abscess about the root of the tooth or an impaction which may be the source of the eye trouble.—*North American Journal of Homeopathy.*

THE EVOLUTION OF THE PRINCIPLES OF JACKSON APPLIANCES

By Joseph D. Eby, D.D.S., Atlanta, Ga.
Professor of Orthodontia, Atlanta Dental College, Atlanta, Georgia.

PART II.

General Review of the Evolution of Removable Appliances

WITH a few minor exceptions, the earlier forms of removable appliances consisted of a plate for a base, with various attachments for applying force. The Coffin split plate, which will forever occupy an interesting place in the evolution of appliances, belonged to these earlier forms (Fig. 1). It was a split vulcanite plate covering the palate, touching only the lingual surfaces of the teeth, relying on the linguo-cervical constrictions for retention. Connecting its halves was a double-looped spring made of 18-gauge steel (piano) wire, which, when the plate was removed from the mouth, could be bent buccally, causing a spring force for lateral development when the plate was snapped back into position. The remarkable results which were at times accomplished with this

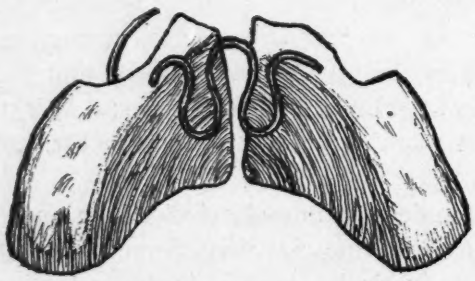


Fig. 1.—Type of Coffin's split spring plate.

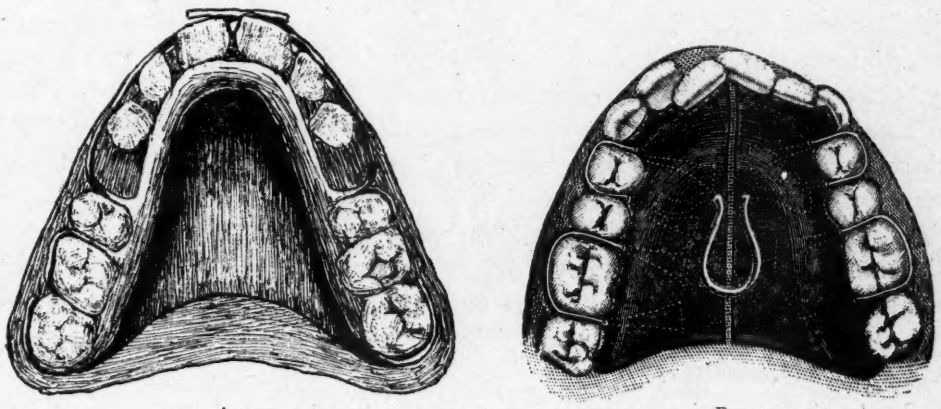
appliance caused it to become very popular, although it was very unstable and very damaging to the tissues.

Coffin was among the first of the pioneers to discover the great value of the spring force for tooth movement. There were designs of vulcanite plates, such as "spring plates"—i. e., those covering only a portion of the palate—and other plates were made to completely cover the palate and the posterior teeth continuous to the bucco-cervical borders. The "bite opening" produced was at that time considered helpful or necessary in most cases. These plates were thickened back of the teeth which were to be moved from within outward, and threaded wire screws were inserted to press against the teeth to be moved. These screws could be run up slightly at each adjustment, but there were never any assurances of force or security. For pressure from without inward, the spring wire was bent across the occlusal surfaces, which, when bent inward, produced the desired pressure, so far as general pressure was concerned, without the slightest control of details. These appliances were very inefficient, uncleanly, unstable, brittle, with the result that tooth movement was more the ex-

ception than the rule. The bulk and position which these designs occupied in the oral cavity were very objectionable.

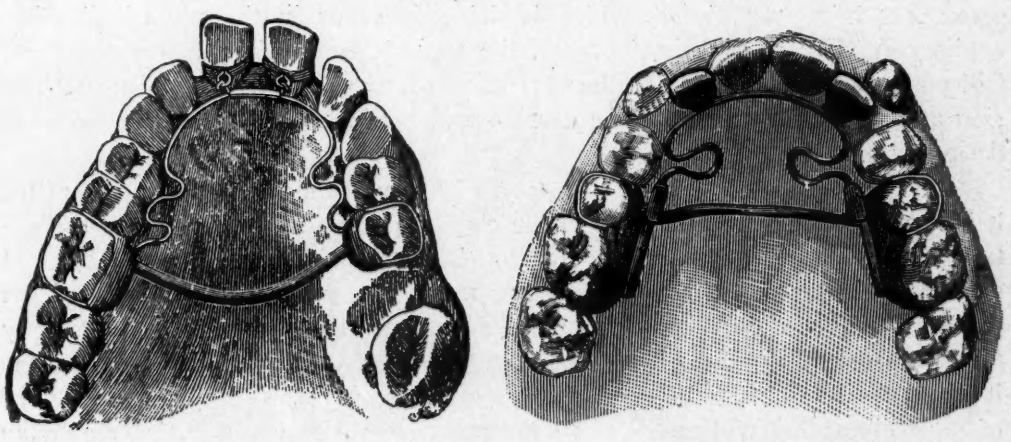
Among Dr. Jackson's earliest ideas which led to the development of his system was an improvement on these palatine plates by the addition of wire clasps made to cross the occlusal surfaces at the interproximal occlusal grooves, and to fit snugly at the bucco-cervical borders, thus gaining a secure purchase at these points.

In Fig. 2, *A* shows his addition of partially encircling clasps around the molars and *B* shows completely encircling clasps around the first bicuspids and



A. *B.*

Fig. 2.—*A* shows partially encircling clasps around the molars, and *B* shows completely encircling clasps around the first bicuspids and first molars in a split spring plate.



A. *B.*

Fig. 3.—*A* and *B* show all-metal device with clasps so constructed as to be connected across the palate with wires, from which springs are extended.

the first molars in a split spring plate. The improvement in these clasps tended toward the elimination of the bulky, brittle, uncleanly vulcanite in favor of an all-metal device, with the clasps so constructed as to be connected across the palate with wires, from which springs could be extended the same as with the vulcanite (Fig. 3).

These original designs of Jackson's all-metal removable appliances were limited for the various directions of tooth movement required for the correc-

tion of all forms of irregularity, but the great range of these designs soon made it possible for a system to be perfected, governed by definite principles and adaptable to the ingenuity of the designer for the correction of all classes of irregularity. The Jackson system reached a stage of perfection between 1895 and 1900, taking the lead among the removable appliances. Having mastered the technic of these appliances, Dr. Jackson obtained the most beautiful results, and those operators who realized the superior qualities of the spring force, and the elimination of all of the many objectionable features of the "fixed" types, have adopted the Jackson system.

The weakest feature in removable appliances is the ease of removal by the patient, inviting failure by lack of co-operation. The attachments could also be loosened sufficiently to cause secondary lines of tooth movement, creating tipping, elongation, depression, etc., the same condition to be contended with in the "fixed" types, although not so severe and far more easily corrected. The Jackson system has also been subject to abuse in the hands of inefficient designers and poor technic of construction.

Through a process of continual improvements, Dr. Jackson has produced in his modern appliance a removable-fixed apparatus, which is less extensive in construction, standardized in design, and possessing the following advantages:

1. It can be easily made impossible for a patient to remove, being removable only by the operator.

2. In the case of a co-operative patient it can be carefully removed, so as to maintain an ideal degree of cleanliness, and by not touching any soft tissues it will not cause irritation or destruction of tissue, or any other temporary or permanent injury or disease which is liable to occur in the use of all other appliances. For use in simple cases, the typical removable Jackson appliance still possesses great value. In the correction of complicated cases of neutroclusion and in the treatment of distoclusion and mesioclusion the removable-fixed designs are indicated.

In considering further the new type of removable-fixed Jackson apparatus, it is necessary to direct attention to the correct principles of design and the details of technic in constructing *perfect-fitting* removable appliances. The first step in designing a Jackson appliance is to make a careful comparison of the existing malformation with the normal, and by measurement ascertain exactly the direction and amount of movement required in each individual tooth to place it in its normal position. After this the most comprehensive plan with a view of producing what will prove to be the most effective operation, is to arrange the springs as nearly as possible according to the movement of the hands and fingers, as if the teeth or the model were flexible and could be correctly aligned in this way. By this plan the Jackson appliance may be compared with the human body—the heavy wire connecting the sides representing the body, the regions on the buccal sides (including the clasps, etc.) representing the arms and all extensions from these parts in the form of springs being compared with the digital movements of the fingers. By grasping a model after diagnosis is complete, and "rehearsing" the tooth movement as it would be made with the fingers, the most effective design of the Jackson appliance will usually be suggested.

INSTRUMENTS.

The instrumentation for Jackson appliances consists of short, straight-ended scissors, combination punch and contouring pliers (S. S. W. No. 112), straight,

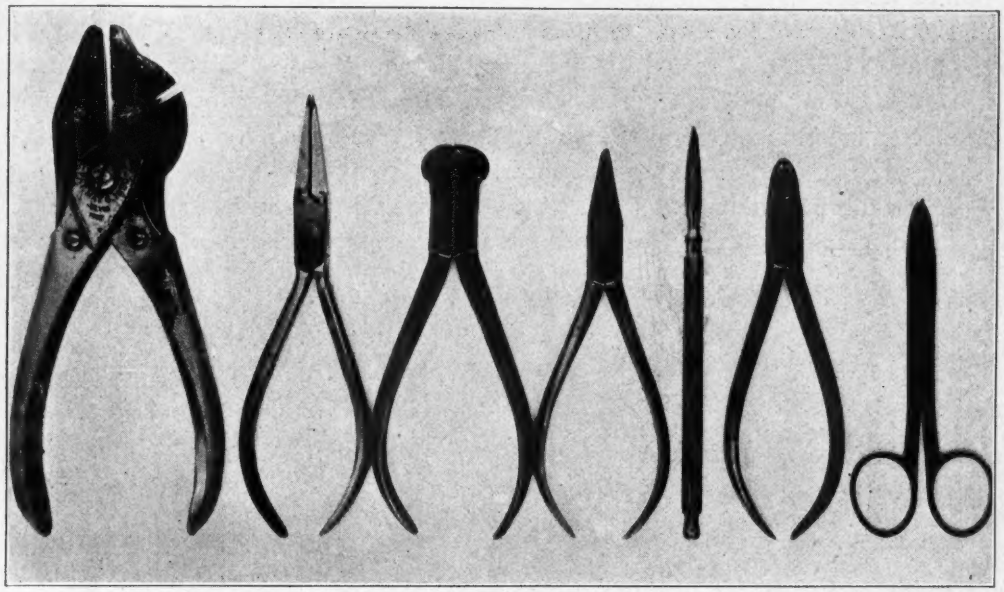


Fig. 4.—Instruments used in technic.

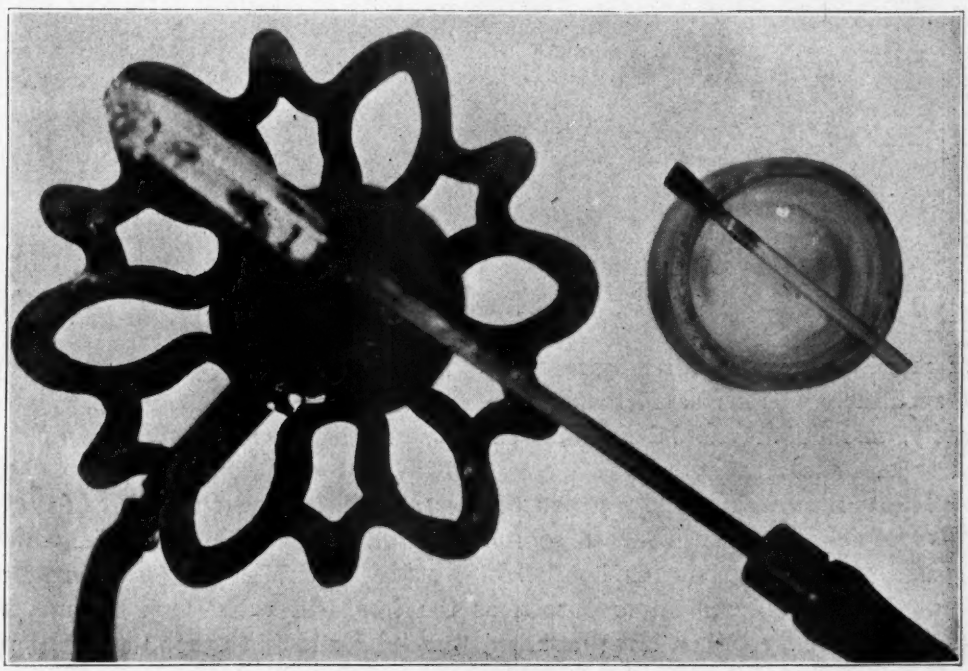


Fig. 5.—Soldering equipment, consisting of a brush burner and a 1-pound pair of soldering coppers.

flat-ended instrument for adaptation, wire cutters, long-nosed or "office and laboratory" pliers, very small-ended, round-nosed pliers, and parallel pliers (Fig. 4). There are no other pliers which can be properly substituted for the S. S. W.

No. 112 contouring pliers in contouring the plates for the lingual surfaces of the anchor teeth. All other contouring pliers will undercontour or overcontour and crimp the strips, whereas these particular pliers will contour a uniform concavo-convex plate, subject with ease to perfect adaptation to the lingual surfaces.

The round-nosed pliers are to be used for practically all wire bending, and should be very small at the end for very accurate bending. The ends of these pliers can be made small by clamping them in a vise *with the jaws of the pliers closed,* and with a strip of emery cloth uniformly reduce the exterior diameter of the points. Parallel pliers for heavy wire bending, with the side cutters, for wire cutting, are indispensable.

The soldering equipment (Fig. 5) consists of a brush burner and a 1-pound pair of soldering coppers. These irons should be pure copper, as the composi-

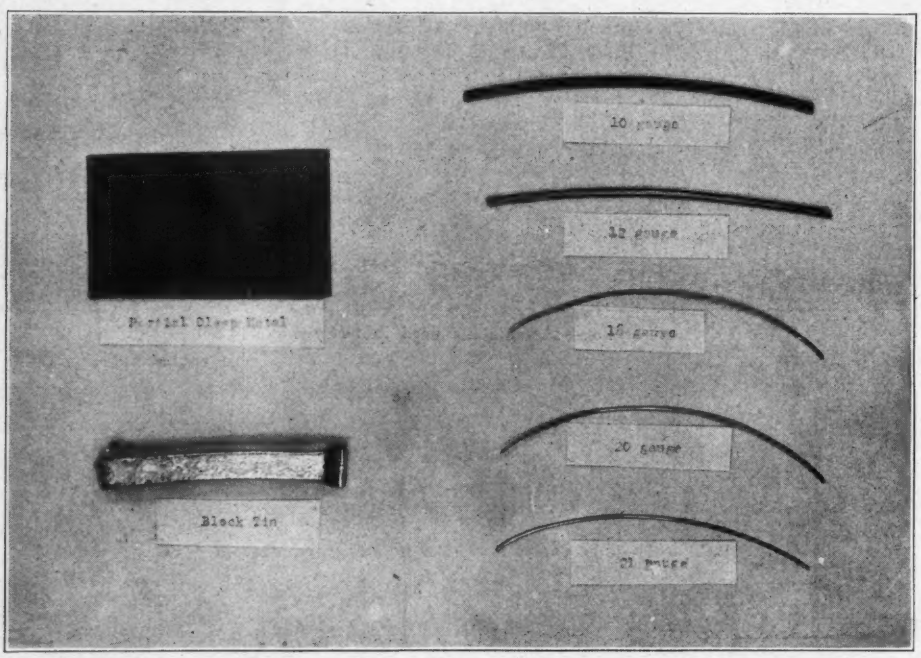


Fig. 6.—Materials used in technic.

tion metal iron will oxidize more rapidly, will pit, and will not control block tin accurately. Irons smaller than the 1-pound pair (½ pound each) burn rapidly, and do not hold heat long enough, and larger irons are too clumsy and require too long to heat.

The flux is a saturated solution of zinc chloride, to be applied abundantly with a camel's hair brush. This solution can be made better than that which is usually bought by pouring hydrochloric acid (C. P.) slowly over zinc globules. Zinc should remain in excess, as the free acid will attack the metals. This solution is kept in a large-mouthed vessel (Fig. 5) in order that the iron may be kept perfectly tinned by immersion of the point after each heating.

MATERIALS.

The first material to be mentioned is Jackson's partial clasp metal, 36-gauge (Fig. 6). This is a specially prepared stiff material, not to be annealed, which

responds to the contouring pliers, but is so resistant to bending that it will not yield to stresses brought against it in the acts of manipulation of the appliance. This metal has been treated on one surface to gain a very tenacious attachment with tin, and it is impossible to scale off the plates when made of this special metal. All other substitutes—such as low karat gold, copper, bronze, platinoid, German silver, silver, or brass in any form—cannot be used with success as they lack one or both of the essentials of hardness and secure attachment in the solder. This metal possesses a gold surface for contact against the enamel.

The wire used is an alloy of nickel silver, as springy as possible and also bendable (Fig. 6). The gauges required are: Nos. 20- and 21-gauge for clasps, Nos. 18- 19 and 20-gauge for finger springs, and Nos. 10- 11- and 12-gauge for connecting body wires. This material can be purchased at supply houses. The solder must be the purest block tin (Fig. 6). Manufacturers market block tin which abounds in arsenic and is slightly irritating, and the best tin procurable is the high-test tin used in the making of alloys. "Half-and-half" soft solder should *never* be used.

In the next issue will appear the illustrated construction of Jackson appliances for lateral and forward development.

"Dental Hygienists"

MORE and more the importance of dental hygiene, particularly for school children, is being recognized. In a recent address at the Forsyth Dental Infirmary for Children, the director of that institution emphasized the dangers of poor teeth in school children both for themselves and for others. "All must share in the morbid pathological conditions of the neglected child, and this is particularly true concerning tooth and mouth conditions. The time is rapidly approaching when a child will not be allowed to enter a public school until he is physically fit." Even disease of the first teeth, which have been too often disregarded because of their transient nature, is capable of producing lasting effects upon the child. When the temporary teeth are lost prematurely, the permanent teeth erupt unassisted into various conditions of irregularity and malocclusion, which greatly interfere with the growth of bones of the head. Deformities of the nose and mouth may result, which interfere with respiration and with voice production. Absorption from septic processes in the mouth has been much discussed of late.

Granting the truth of these facts does not settle the problem. The question of how to get so many thousands of mouths cared for, presents a number of difficulties. The interest recently aroused in dental hygiene has flooded the dentists with work. Many people cannot afford regular dentists' fees for cleaning, and the elementary part of the work, which is sufficient for the teeth of many children, should not require the time of a dentist.

Laws dealing with this situation have been enacted in Massachusetts and Connecticut, and now the Governor of New York State has recently signed a bill which provides for the training, registration and licensing of the "dental hygienist." The new law provides that any dental dispensary or infirmary, legally incorporated and maintaining a proper standard and equipment, may establish for women students a course of study in oral hygiene. One year's attendance at high school and one year's training in oral hygiene are required to become a licensed "dental hygienist." The person so licensed "may remove lime deposits, accretions, and stains from the exposed surface of the teeth, but shall not perform any other operation on the teeth or tissues of the mouth."

It is to be hoped that plenty of "dental hygienists" will be developed and that the portion of the public, who heretofore have been unable to afford dentists' services save for the worst toothaches, will appreciate the value of clean mouths and avail themselves of the opportunity.—*Boston Medical and Surgical Journal.*

THE EVOLUTION OF THE TREATMENT OF DISTOCLUSION*

By W. G. Barr, D.D.S., Wichita, Kansas.

As a result of the advancement of orthodontic methods in the past few years, the treatment of no other class of malocclusion has passed through such evolutionary stages as that of distoclusion. From the study of orthodontic literature, as has been taken up by Dr. Weinberger, it is very readily shown that certain conditions, which we now recognize as distoclusion, must have been recognized very early in the history of medical science. I do not, however, care to take up your time by going into the various ancient methods of the treatment of this condition, which is also known as Class II, Division 1, but the protrusion of the upper central incisors was recognized very early, and such protrusions undoubtedly were associated with distoclusion as we know it today.

If we simply take up what might be termed modern orthodontia, we will find at least four different plans of treatment which have been advocated in the last ten years, and one or more of these plans are still followed by some men. Those of us who have had any experience realize that the majority of our patients with distoclusion and labioversion of the incisors, or Class II, Division 1, cases, come to us primarily to have the protrusion of the upper incisors corrected. A great many of them do not understand that the real, serious condition exists in the distal relation of the lower dental arch along with the underdevelopment of the mandible, which accompanies such types of malocclusion. It is the symptom of the labial protrusion of the upper incisors that causes the majority of patients to seek relief. It is, therefore, logical to conclude that the early treatment of distoclusion was directed toward the symptom rather than toward the treatment of the condition. While it is a fact that the relation between mouth-breathing and distoclusion was recognized very early by the dental and medical professions, it is also a fact that it was comparatively only a short time ago that these two professions began to comprehend the correlation which existed between the orthodontic and rhinological treatment of those cases, and it is for this reason that one of the earliest plans of treatment of distoclusion consisted in the retraction of the upper anterior teeth. In other words, the plan may be stated as consisting of the reduction of the size of the upper arch to make it harmonize with the lower arch, and has for its object merely the improvement of the occlusion and restoration of harmony in the sizes of the arches. While this statement is not exactly anatomically correct, nevertheless the upper anterior teeth were moved distally after the extraction of the first premolar on each side and made to harmonize with the lower anterior teeth. Now, this line of treatment appealed to a great many patients because the protrusion was the objectionable feature. They did not know that the distal movement of the upper incisors would produce a facial deformity equally as obnoxious from an artistic standpoint as the protrusion of the upper incisors; they did not understand that, by retracting the upper anterior teeth and mak-

*Read before the Sixth Annual Meeting of the Alumni Society of the Dewey School of Orthodontia, Kansas City, Mo., February, 1916.

ing them conform to the lower anterior teeth, there would be produced a facial deformity equally as undesirable as the first. In fact, one facial deformity was created in an attempt to correct another. The facial outline obtained by such a treatment may at first seem to be an improvement, but it is inclined to become more objectionable as the individual grows older. Owing to the abnormal position of the anterior teeth in such cases, the muscles of expression, especially the orbicularis oris and labial muscles, are in such a position that the expression of the face is always very unpleasant. The mandible, being underdeveloped because of the distal relation of the lower teeth, always remains underdeveloped if nothing is done to cause it to develop forward.

This type of treatment may be said to have for its object the reduction of the anterior teeth without any idea as to the improvement of the occlusion of the molars and premolars. Nothing is done to improve nasal breathing because the upper arch is not expanded; nothing is done to produce the development of the

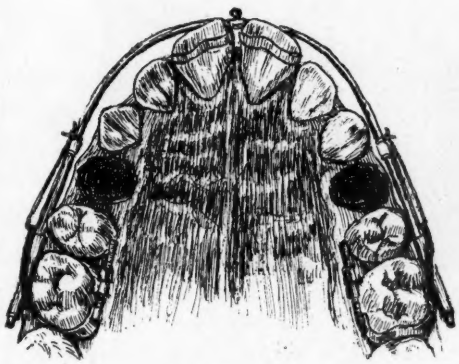


Fig. 1.

Fig. 2. (After Angle.)

mandible because no effort is made to move the mandible forward. Of course, with this plan of treatment,[1] occipital anchorage (Figs. 1 and 2), is employed to move the upper anterior teeth distally. An objectionable result of this treatment is the excessive overbite, which is always produced by the distal movement of the anterior teeth without moving the lower arch forward (Fig. 3). While this plan of treatment is not adopted to any great extent by many orthodontists at the present time, still the plan is being followed by some in the dental profession, and is even being advocated by a few orthodontists as the proper treatment for extreme labioversion of the upper incisors. We know that this plan of treatment is the oldest that was used for distoclusion, and which, by the way, did nothing to correct the defect, but simply dealt with one of the prominent symptoms.

What I believe to be the second distinct plan in the evolution of the treatment of distoclusion was the method originated by the late Dr. Norman W. Kingsley, which became known to the dental profession as "jumping the bite."

[1]Angle: Malocclusion of the Teeth, 6th ed., p. 235.

While there is no question that Dr. Kingsley appreciated the occlusion of the teeth, especially from an artistic standpoint, he has laid very little stress in his writings on the normal occlusion of the teeth as a factor in the masticating efficiency of the teeth. It seems as if his idea in the treatment of distoclusion was to devise some plan which would improve the facial outline to a greater extent than the method that was being followed up to that time as the universal practice.

Dr. Angle, in the sixth edition of his work,[2] says: "The second plan of treatment is toward the ideal—the establishing of normal occlusion, normal relations of the dental arches, and normal facial lines, as we have already noted." This plan of treatment had for its object the expansion of the upper arch, the reduction of the protrusion of the anterior teeth, and the forward movement of the mandible, thereby establishing normal occlusion and improving the facial outline by the forward movement of the mandible. This plan consists in the expansion of the upper arch and the retraction of the anterior teeth by means

Fig. 3.

of a skull cap, the expansion of the lower arch so as to place each tooth in its proper position with the line of occlusion, and then the forward movement of the mandibles by the voluntary action of the external pterygoids. Dr. Angle says: "This means the retention of all the teeth, the restoration of each to harmony with its line of occlusion, the changing of the teeth from distal to normal occlusion by moving the lower jaw forward and compelling normal closure of the jaw by some form of device until normal occlusion shall have been thoroughly established, and the jaws and muscles, and especially the temporo-maxillary articulation, shall have been modified into this changed occlusion." By this plan much better facial outlines were obtained than was possible by the older plan, because this plan was actually the treatment for distoclusion, and overcame, to a certain extent, the underdevelopment of the mandible by its forward movement, thereby bringing the chin forward—very nearly, if not entirely—to its proper position. By this method certain conditions known as "before and after results" could be obtained very readily, for there was no question about securing the expansion of the upper arch and the retraction of the

[2]Angle: Malocclusion of the Teeth, 6th ed., p. 247.

anterior teeth by means of a skull cap; neither was there any difficulty in expanding the lower arch, and there was no difficulty in having the patient move the mandible forward by voluntary muscular action. So far as the treatment was concerned, we might say that it was very simple.

The difficulty, however, which arose was the matter of retention. In fact, Dr. Kingsley contended up to the time of his death, that retention was the problem of orthodontia. He claimed that teeth could be moved to almost any position, almost any distance, but stated that the perverseness of inanimate objects to return to their former positions was something that would always have to be contended with. Part of his argument for considering retention a problem was probably because with this plan of treatment, which was called "jumping the bite," the holding of the mandible was a very difficult procedure. How to secure retention was the question, and it was a problem because the treatment, as outlined here, was not along anatomical lines. The treatment will remove the difficulty, overcome the facial deformity, and correct the distal relation of the dental arch, but, in doing so, certain parts are thrown on a stress or strain, which makes it very difficult to retain them in position. By that we mean that in the forward movement of the mandible the head of the condyle leaves the glenoid fossa and rests on the eminentia articularis, with the result that the fibers of the external capsular ligament are placed on a strain. In the same manner the fibers of the temporal muscles, which are so constructed that, when they act, the mandible is moved distally, are always struggling and pulling to bring the mandible back to the old position during the process of mastication. The other ligaments in the temporo-mandibular articulation—namely, the sphenomandibular and stylo-mandibular ligaments—are also on a stress; for, when the mandible is protruded, they are necessarily put on a strain because their attachments are moved forward, which has the effect of shortening the ligaments, and pulling the condyle up against the interarticular cartilage and compressing it between the eminentia articularis. For that reason, after the mandible has been moved forward by voluntary action and attempts are made to retain it, there are active forces continually struggling to pull the condyle distally, and therefore it requires a continual effort to keep the mandible forward; if the mandible is not kept forward, of course, the dental arch will also return to its old position. Part of the trouble in retention was on account of the faulty means employed for the purpose at that time, the retaining appliances being of a weak variety, and generally with very insecure anchorage (Fig. 4). As a result, the appliances were constantly breaking, the mandibles drifting back, and the teeth resuming old positions. Some cases appeared to be successfully treated by this plan because the appliances retained the teeth, but it is the belief of the writer that the condyle eventually slid back to its old position. There were strong arguments pro and con for this plan of treatment, and owing to the improved facial results which were occasionally obtained by this new plan, it was continually tried, with more or less success, by men who had a high appreciation of artistic results. But, on account of the difficulty of retention encountered in the second plan of treatment, known as "jumping the bite," and because of the unsatisfactory results from a facial standpoint, obtained by the first plan, a certain number of men were continually making efforts to perfect

a technical procedure which would overcome some of the objections of the two plans.

With the publication of Dr. Angle's work on malocclusion and the founding of his school, a method of treating distoclusion was developed known as the Baker anchorage. It will probably not be amiss to give a short history of the Baker anchorage, which has been described as various forms of intermaxillary anchorage, but to Dr. Baker, of Boston, belongs the credit of having brought to the attention of the dental profession a plan which, with certain modifications, has been revolutionary in the treatment of distoclusion. Up to the time of Dr. Baker's description of his use of his intermaxillary rubbers, the profession knew very little about reciprocal intermaxillary anchorage. Now, it is probable that Dr. Baker was not the first one to use intermaxillary anchorage, but it was he who brought it to the attention of the profession—not so much through his writings as by the literature of Dr. Angle and some of his students. Intermaxillary anchorage as used by Dr. Baker, was very crude compared with intermaxillary anchorage of today (Fig. 5), but it was the beginning of the scientific treatment of distoclusion, and his work and the plan as explained by

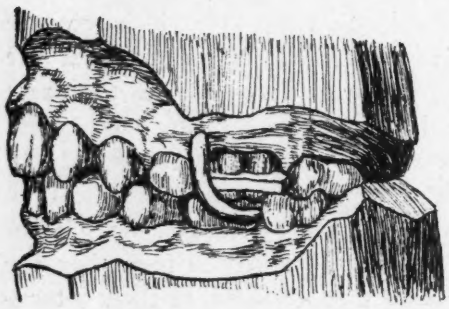


Fig. 4. (After Angle.)

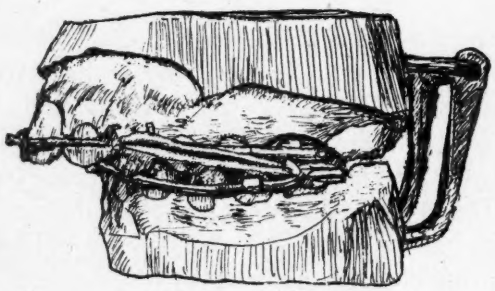


Fig. 5.

Dr. Angle in his seventh edition may be said to be the third plan of the treatment of distoclusion. This plan was not devised entirely from an anatomical standpoint, nor was it intended to completely remove the pathological conditions as they may exist, but it was devised more to overcome the difficulties which were encountered in the previous two plans of treatment and present a procedure which would be much more simple and be scientifically correct from a mechanical standpoint.

It has been stated that the objection to the plan recommended by Dr. Kingsley, known as "jumping the bite," was the difficulty of retention on account of the condyle "insisting" on moving back into the glenoid fossa after the mandible had been moved forward. With the use of the Baker anchorage, as described by Dr. Angle in his seventh edition, an effort was made to shift the mesio-distal relation of the teeth and avoid a forward movement of the mandible. It was the belief that by shifting the position of the teeth and bringing the inclined planes in proper relation, there would be a development of the mandible, which would tend to overcome the facial deformity which was present in those malocclusions. The object of this plan was the distal movement of the upper incisors and the enlargement or expansion of the upper arch, as well as the distal movement of the molars and premolars of the upper arch.

The lower dental arch is moved forward about half the width of the premolar, and, as the upper teeth have been moved backward half the width of the premolar, there would be a normal mesio-distal relation of the teeth to each other, with the result that there would be more or less tipping of the upper and lower teeth. The forward movement of the lower teeth improved the facial deformity to a certain extent, but the distal movement of the upper molars and incisors beyond what is now believed to be the anatomical position in the majority of cases produced a facial outline which was not very pleasing. In a number of cases treated by this plan it was found that, while a great improvement of the facial outline was produced, the position of the mandible, so far as mesio-distal relation was concerned, was not exactly what it should be, although in some of the cases, where the mesio-distal relation of the teeth remained normal, there was a development of the mandible, which, to a certain extent, overcame the deformity or lack of development which existed immediately after treatment. The retention in the cases treated by this plan was not as difficult as the retention in the cases treated by Dr. Kingsley's method, known as "jumping the bite," because the teeth had been moved only in their processes, and that was all that was required. The mandible, having remained in its proper position so far as the condyle was concerned, did not require any retention to prevent the condyle from slipping back in the glenoid fossa. The retention in these cases, when this plan of treatment was first used, was not, however, as easy as might be supposed, owing to the faulty method of retention which was employed.

Of these three plans of treatment, passive intermaxillary retention was the kind which was usually employed; in fact, so far as I know, it was the only plan or type of retention which was used for a number of years. The experience with this kind of retention, which consisted in the use of some form of the plane and spur, led Dr. Watson to make the statement several years ago that while we could regulate teeth with a certain degree of nicety, move them practically where we desired, we nevertheless encountered great difficulty in retaining them. In other words, in the evolution of the treatment of distoclusion the theory of treatment progressed much more rapidly than the fact of retention, and this condition prompted various persons to endeavor to develop some practical method of retention.

Law, of Berlin,[3] and Dewey began working on a certain principle of procedure at about the same time, the two methods being somewhat similar, and a little later, Watson, of Detroit, read a paper before the American Society of Orthodontists on this subject, referring to retention as a problem, which indicated that practical retention was not a success at that time, as the men engaged in the development of a new method were working along different lines. As a result of the work of these men, active intermaxillary retention was finally evolved, which was the simplest method that could be adopted, for it can readily be understood that if a certain force is used to move a tooth, the same force is necessary to retain it, and therefore the intermaxillary rubbers which have been used in tooth movement are now employed in retention. Of course,

[3]The Retention of Class 2 Cases—The Staple and Hook Sectional Retainer. A paper read before the European Orthodontia Society. Published in the American Orthodontist, Vol. i, No. 4.

this was a revolutionary principle so far as the old idea of retention was concerned, for it had been held in times past that in order to retain a tooth it must be held rigid. It is now the opinion of men of experience, among them Dr. Noyes, whose reputation as a histologist is beyond question, that the way to retain a tooth is not to hold it rigid, but to hold it in such a position that it will respond to all the forces of mastication, or what is now known as the "forces

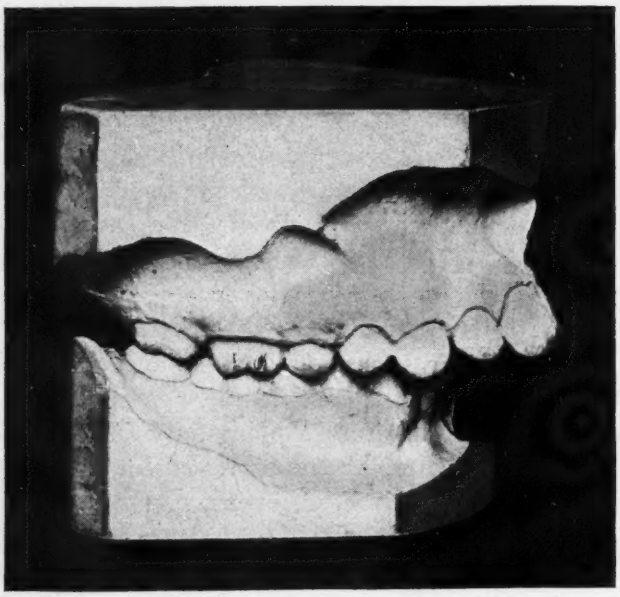


Fig. 6.

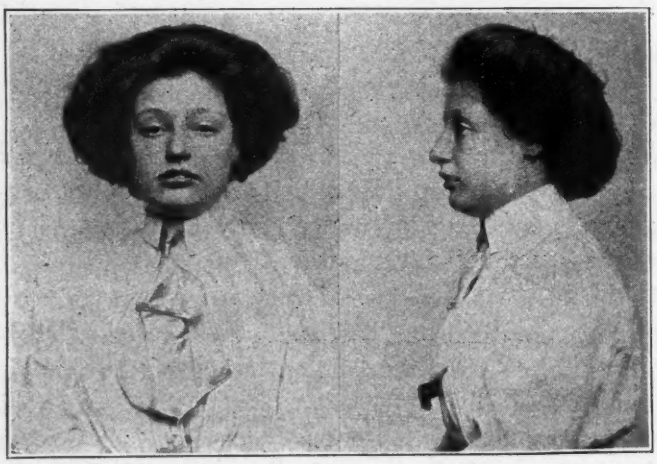


Fig. 7.

of occlusion." Retaining appliances are divided into active and passive devices and the forces of retention are divided into natural and mechanical. Mechanical retention is only a means of assisting the natural forces, and therefore retention, after the treatment of distoclusion, is more easily secured.

With this third plan of treatment, after retention had been worked out, it was still the desire of some men to have a greater facial improvement than had

been previously obtained. A treatment, based entirely on the pathological conditions as found in this class of malocclusion, and with the aid of regulating appliances now obtainable, was therefore devised which had for its object the elimination of all the deformities and pathological conditions which a case may present.[4] In other words, that treatment was to produce a normal occlusion

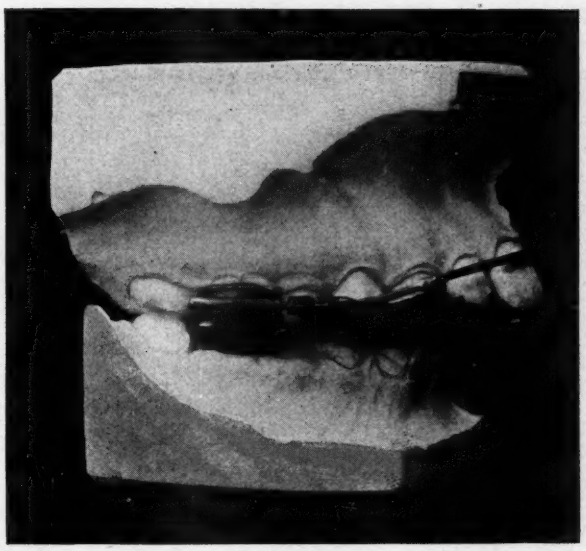


Fig. 8.

Fig. 9.

with a normal facial outline. If one will consider this matter for a few minutes it will be realized that the pathological conditions found in this type of malocclusion are distoclusion and labioversion of the upper incisors—or, in other words, Class II, Division 1 (Fig 6)—consisting in an underdeveloped mandible,

[4]See treatment of Class II, Division 1, Practical Orthodontia (Dewey).

with a distoclusion of the lower arch, a narrow upper arch, and protruding upper incisors, abnormal lip action, and abnormal breathing (Fig. 7). The breathing must be treated by rhinological interference. Taking each arch separately, the treatment of the upper arch should be its expansion and moving distally the incisors, so as to make a normally shaped dental arch. As the upper molars and premolars are not forward in the majority of cases, no effort should be made to move them distally. In this plan we notice that the differ-

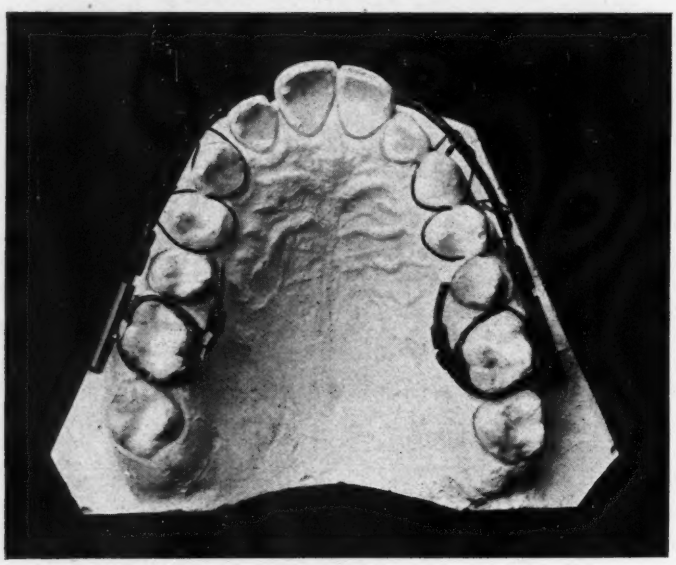


Fig. 10.

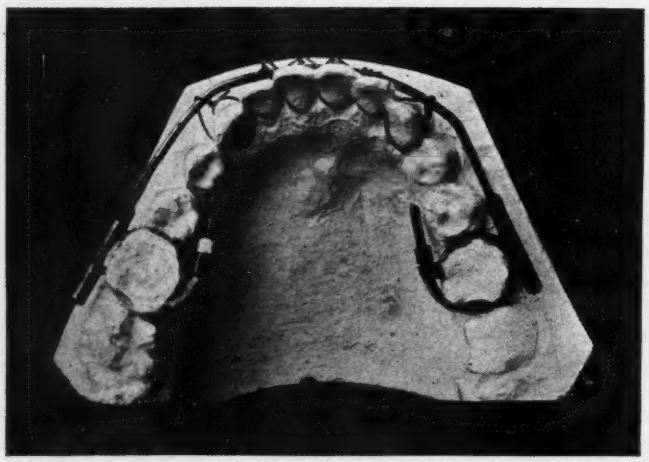


Fig. 11.

ence between this treatment and the one outlined by Dr. Angle in his seventh edition is the manner in which the upper dental apparatus is treated. The attempt is then made to move the lower teeth forward the entire distance, or move them from the position of distoclusion to one of normal occlusion as compared with the upper teeth. This means a forward movement of the lower arch practically twice as far as recommended by Dr. Angle. The forward

movement of the lower arch causes the development of the mandible, which development is in the body of the mandible and not produced by a forward movement of the condyle. Realizing the difficulty that Dr. Kingsley encountered with his plan of "jumping the bite," we have planned to avoid such a condition, and, believing that we can get a development of the body of the mandible by the proper application of mechanical force, we endeavor to obtain that development by using intermaxillary rubbers to move the teeth forward.

The objection to the third plan of treatment was that it produced too great a

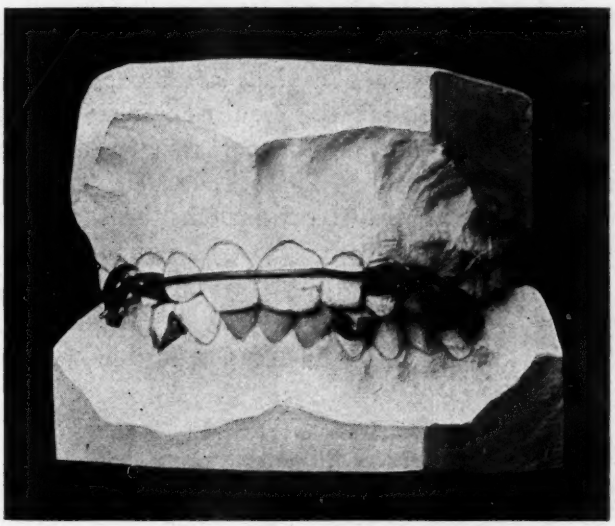


Fig. 12.

Fig. 13.

tipping of the molars and premolars; but, with the proper application of force, which may be produced by putting spurs on the front part of the lower arch to prevent the tipping of the lower incisors, or by a slow movement of the lower teeth, depending on the occlusion to keep them straight, we are able to move the lower arch forward the entire distance and still preserve the teeth in an upright position. In adjusting the mechanical appliances to produce such a tooth move-

ment, the alignment wire is first adjusted on the upper dental arch, with the wire resting against the incisors in the anterior region, and the nut being away from the tooth on the molar band (Figs. 8 and 9)—that is, the initial force of the intermaxillary rubbers must be exerted directly upon the upper incisors, with the canines ligated to the alignment wire in such a manner as to expand them (Fig. 10). After the arch has been expanded in the canine region and the incisors moved distally, the nuts on the upper alignment wire are allowed to rest against the tubes on the upper molar bands. All the upper teeth are then ligated to the alignment wire to produce as much resistance as possible, which resistance is required to move the lower dental arch forward. In moving the lower arch forward, the teeth are brought forward in mass (Fig. 11)—that is, the molars, premolars, incisors, and canines are moved forward at the same time—and any expansion which may be required is also produced at that time in order that the lower arch will fit the upper arch when the lower teeth have been moved forward.

Now, this plan of treatment differs from other methods practiced by some

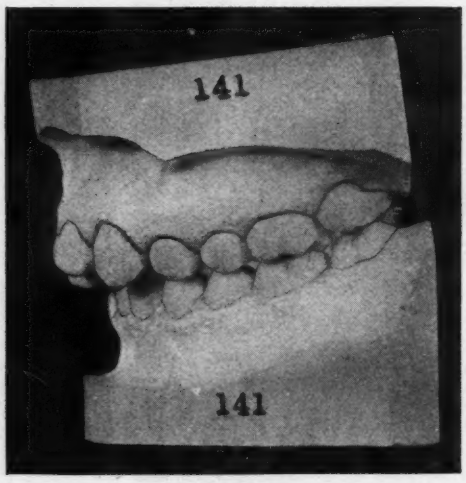


Fig. 14.

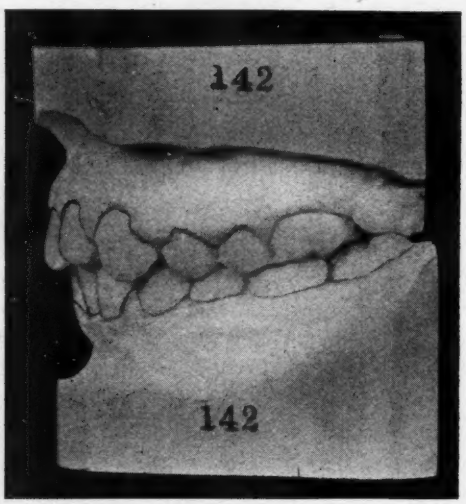


Fig. 15.

men in that they would first move the incisors and canines forward in the lower arch, then the premolars, and, lastly, the molars. The objection to the plan of moving the teeth forward in sectional groups is that it prevents the approximal contact of the lower arch, needlessly destroys a large amount of alveolar process by causing absorption and rebuilding, and, to a certain extent, lengthens the time of treatment. If the necessary resistance is obtained in the upper arch with the proper application of the alignment wire, it is possible to move the entire lower dental apparatus forward at one time, thereby preserving the approximal contact and keeping the teeth in a much better position, making it easier to retain them than if they had been moved in groups. After the teeth have been moved, they are, of course, retained by active intermaxillary retention, which consists of a lingual arch on the lower teeth, with the use of a labial arch in the molar and premolar region above, and a fine bar running labially to the upper incisors (Fig. 12). In this plan of treatment we almost invariably

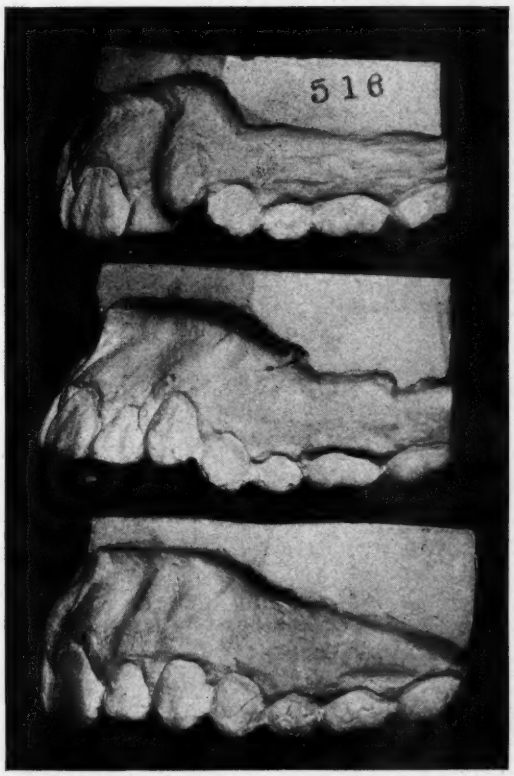
elongate the lower molars, which is to be desired, for the reason that the majority of distoclusions, with labioversion of the upper incisors, are complicated by an infraocclusion of the molars. By moving the teeth forward, there is a tendency for the lower molars to be elongated, and as stated, this elongation is desirable, as it also has a tendency to produce a development of the mandible, increasing the length of the lower part of the face (Fig. 13). By examining results obtained in this plan of treatment with patients of various ages, it has been found that a much better facial effect is obtained, as the object is to remove the prevailing pathological conditions and thereby establish normal occlusion and normal facial outline. Case No. 141 (Fig. 14) is a distoclusion which was treated by this method and Fig. 15 shows the finished results.

The full report of a class of distoclusion in which the fourth plan of treatment was employed was published in the *International Journal of Orthodontia,* November, 1915, to which those interested are referred.

A REPORT OF A CASE TREATED WITH THE PIN AND TUBE APPLIANCE

By Walter H. Ellis, D.D.S., Buffalo, N. Y.

THIS case report is intended to show the superiority of the Angle pin and tube appliance over the older form, that of the plain arch and ligature wire, where the bodily movement of the teeth is required. Not only was the bodily movement of the incisor teeth necessary, but the apices required moving farther than the crowns.



The upper model shows the case before treatment. The second model shows the same case after the use of the plain arch and wire ligature for five and one-half months. The result was the best possible with that appliance. Note the decided slant of the incisors and the lack of development in the apical region,—truly a great opportunity for "bone growing."

At just this time in the treatment, Dr. Angle gave us his new technic for bodily tooth movement. The pin and tube appliance was adjusted and after its use for twelve months, the result as shown in the lower model was obtained.

This case is, in my estimation, a very graphic illustration of the superiority of bodily movement of teeth in this type of case.

THE HISTORY OF ORTHODONTIA

(*Continued from page* 211.)

By Bernhard Wolf Weinberger, D.D.S., New York City.

FREDERICK HIRSCH (1799), in his *"Correction of Dental Anomalies,"* relates a case in which the deformity consisted of the union of two central incisors forming one single piece, resembling a paddle, and spoiling the appearance of the face. He divided them with a saw, cauterized the surfaces of the sections, scarified the gum, and to gain a little space, introduced a small

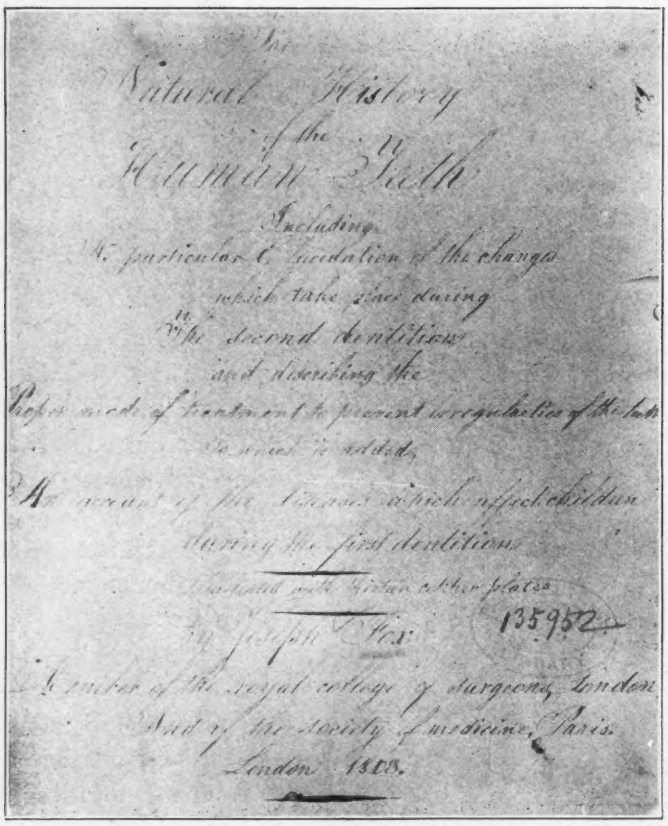

The
Natural History
of the
Human Teeth
Including
A particular Elucidation of the changes
which take place during
the second dentition
and describing the
Proper mode of treatment to prevent irregularities of the teeth
To which is added,
An account of the diseases which affect children
during the first dentition
Illustrated with fifteen other plates
By Joseph Fox
135952
Member of the Royal college of Surgeons, London
And of the Society of medicine, Paris.
London 1803.

Fig. 1.—Title page. Joseph Fox, "Natural History of the Human Teeth," etc., 1803. From the original manuscript, Surgeon-General's Library, Washington, D. C.

wedge, until the gum had grown up within a new dental interstice, thus giving an altogether normal appearance to the part.

J. Arneman (1801) described the changes due to the growth of dental arches, claiming that the deciduous teeth should never be extracted, but be allowed to remain until the permanent teeth take their place, for it was the increased size of those teeth that created growth; that if the deciduous teeth were removed too early lack of development would result. He wanted to avoid the use of the pelican.

Joseph Fox, in his *"Natural history of the human teeth—describing the*

(Copyright 1916 by Bernhard W. Weinberger.)

proper mode of treatment to prevent irregularities of the teeth," published in 1803, was the first to give explicit directions for correcting the irregularities of the teeth and his method of treatment was used for nearly a half a century.

Fox's method of treatment was a great improvement over that of Fanchard and Bourdet. In explanation of its use Fox says, "To remove the form of irregularity, two objects must be accomplished; one, to apply a force which shall act constantly on this irregular tooth and bring it forward, the other, to remove that obstruction with which the under teeth always occasion." The first of these objects may be attained by the application of an instrument adapted to the arch, which being attached to some strong teeth on each side, will furnish a fixed point in front, to which a ligature may be applied and thus by occasionally renewing it, a constant pressure is preserved and the tooth may be drawn forward. The second object, that of removing the resistance of the un-

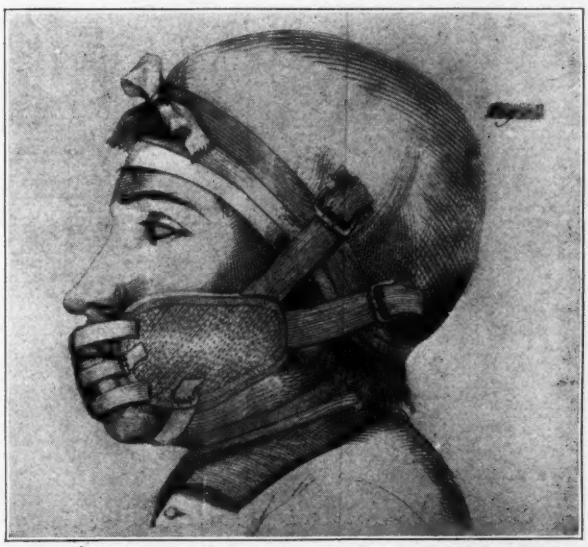


Fig. 2.—Chin-cap devised by Cellier, 1802, though not used for occipital resistance.

der teeth, must be attained by placing some intervening substance between the teeth of the upper and lower jaw, so as to prevent them from completely closing and bringing obstruction to the coming forward of the irregular tooth.

The chin cap was first used by Cellier in 1802 and a year later by Fox, as a occipital mental sling in cases for luxation and not for occipital resistance or anchorage as is generally credited.

As to the causes of these irregularities Fox has the following to say: "The most frequent cause of irregularity is a want of simultaneous action between the increase of the permanent teeth and the decrease of the temporary ones by the absorption of their fangs, most commonly occasioned by the resistance of the nearest temporary teeth; also from the fact that the permanent teeth are too large for the space occupied by the temporary. The growth of more teeth than the natural number frequently occurs and is always the cause of great irregularity of the teeth."

The Irregularity of the Teeth.—"During the shedding of the teeth there

are several circumstances which prevent the permanent teeth from acquiring a regular position, and often give rise to very great irregularity in their arrangement.

"The most frequent cause is a want of simultaneous action between the increase of the permanent teeth, and the decrease of the temporary ones, by the absorption of their fangs. It rarely happens that so much of the fang of a temporary tooth is absorbed as to permit its removal by the efforts of the child, before the permanent tooth is ready to pass through; on which account the new tooth takes an improper direction, and generally comes through on the inside.

"Cases are very frequent in which scarcely any absorption of the fangs of the temporary teeth had taken place previous to the appearance of several of

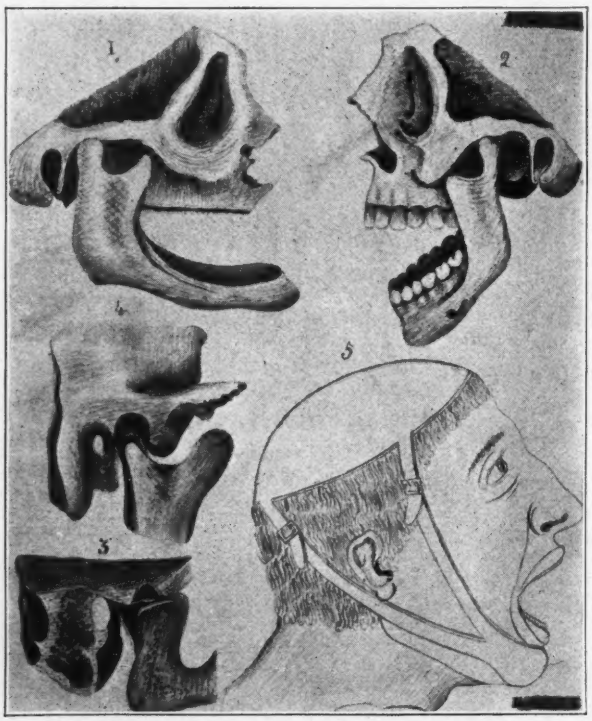


Fig. 3.—Chin-cap devised by Fox, 1803, used as an occipital mental sling for luxation. From original drawings, Surgeon-General's Library, Washington, D. C.

the permanent teeth; and it often happens, that upon the removal of the shedding teeth to give room for the permanent ones, no absorption of the fangs of the temporary teeth has taken place.

"Irregularity of the permanent teeth is most commonly occasioned by the resistance made by the nearest temporary teeth; this always is the case if the temporary teeth are small and close-set, for as the permanent incisors are much larger than the temporary, they require more room; but if the space left by the shedding of the temporary teeth is too small for the regular position of the permanent, they are exposed to the pressure of the next tooth, and hence are frequently turned out of their right direction.

"Another cause of the irregularity of the teeth arises from the permanent teeth being too large for the space occupied by the temporary ones; those parts

of the jaws not being sufficiently extended to permit a regular position of the new teeth—in this case the irregularity is considerable, and occasions great deformity in the appearance of the mouth. The incisors and cuspidati being much larger than those of the child, require more room, for want of which they are turned out of their proper positions. The central incisors overlap each other —the lateral incisors either placed obliquely with their edges turned forwards, or they are pushed back, and stand between and behind the central incisors and the cuspidati; the cuspidati are projected, occasioning the lip to stand out with considerable prominence, and the bicuspids are placed very irregularly."

Varieties of Irregularities of the Teeth.—"I will now describe the different states of irregularity and to avoid confusion take each jaw separately.

"In the under jaw, when the growth of the permanent central incisors has exceeded the absorption of the temporary ones, they grow up immediately behind them, in a direction towards the tongue. These two new teeth are generally so broad as nearly to cover the inner surface of the four temporary incisors. It will therefore be necessary, in order to obtain room for these teeth, that the four temporary incisors be extracted. The new teeth will then gradually come forward, in which they will naturally be assisted by the pressure of the tongue of the child, and may be occasionally helped by the finger of the parent or the nurse.

"When the permanent central incisors have completely grown up, they occupy fully two-thirds of the space which contained the four temporary incisors; therefore when the permanent lateral incisors appear, they are placed partly behind the centrals and the temporary cuspidati; or they grow up with one corner turned forwards and the other pointing backwards. In either of these cases the temporary cuspidati must be removed to give room.

"The four permanent incisors take up nearly the whole of the space of the temporary incisors and cuspidati. The permanent cuspidati are large teeth, and when they have not sufficient room, they occasion very great irregularity. Sometimes they come through on the side, but most commonly they cut the gum on the outside, and project very much out of the circular line from the temporary incisors to the temporary molars. In this case the necessity of the removal of the first temporary molars is obvious.

"It is not very common that the bicuspids of the lower jaw are irregular, because the temporary molars are generally removed before they appear, but when this is not the case, they always come through the gums on the inside, pointing towards the tongue, in which case the temporary molars must be removed, that the bicuspids may rise into their proper situations.

"In the upper jaw the permanent central incisors sometimes pass through the gums behind the temporary ones; when this happens, the four temporary incisors must be extracted, and frequent pressure by the thumb should be applied to the new teeth, in order to bring them forward as soon as possible, and prevent one of the cases of irregularity most difficult to be remedied.

"When the temporary central incisors have come out, the space is generally too narrow for the permanent ones and hence they are pressed into some shape of distortion. Their edges do not assume the regular curve, but stand

obliquely, or even sometimes one before the other. Cases of this kind require the removal of the temporary lateral incisors.

"The permanent central incisors are very broad; they occupy the greater part of the space of the four temporary ones and leave scarcely any room for the permanent lateral incisors; on which account these latter teeth must grow very irregularly; they generally pass through behind, being forced considerably backwards by the resistance of the central incisors and the temporary cuspidati. Sometimes they pass through edgeways, and now and then they project forwards. In any of these cases the removal of the temporary cuspidati is absolutely necessary, and unless the operation be timely performed, the irregularity is with difficulty remedied.

"The greatest deformity is generally occasioned by the want of room for the lateral incisors and the cuspidati, and when too long neglected usually becomes permanent.

"In almost all the cases of irregularity which occur in the under jaw, nothing more is necessary after the removal of the obstructing tooth, than to apply the frequent pressure of the finger, in such a manner as to direct the irregular tooth into its proper place. It will assist the natural tendency of the teeth to form a regular circle, and to take up as large a space as possible, but in the upper jaw, when the irregularity has been suffered to remain for any length of time, it cannot be obviated without having recourse to other assistance.

"Irregularity is often occasioned by the teeth being much too large for the space allotted them, and then it will be necessary to remove one or more of the permanent teeth.

"It has been the common practice to admit the cuspidati to grow down to a certain length, and then to extract them. This operation certainly removed the deformity of projecting teeth, but it destroys the symmetry of the mouth, and takes away two teeth of great importance. The cuspidati are exceedingly strong; they form the support of the front of the mouth, and in the advanced periods of life, to those persons who have the misfortune to lose the incisors, they furnish an excellent means of fixing artificial teeth.

"The first permanent molars often become carious soon after they appear; when this is the case, and the other teeth have not sufficient room, considerable advantage always attends their extraction. Their removal permits the bicuspids to fall back, and gives way for the regular position of the cuspidati.

"The removal of these teeth when decayed ought always to be recommended, although they may not occasion pain, or there be no irregularity in the front teeth, diseased teeth always affect others, and therefore ought never to remain in the mouths of children.

"If they be extracted before the second permanent molars appear, in a short time they will not be missed, because the bicuspids will go back, and the second and third molars will come forward, so that no space will be left.

"When the permanent incisors of the upper jaw have cut the gum behind the temporary teeth, and have been suffered to remain until considerably advanced in growth, they always stand so much inwards, that when the mouth is shut, the incisors of the under jaw stand before them, which is always an obstacle to their acquiring regularity, and occasions a great deformity.

"There are four states of this kind of irregularity. The first when one central incisor is turned in, and the under teeth come before it, whilst the other central incisor keeps its proper place standing before the under teeth.

"The second is, when both the central incisors are turned in, and go behind the under teeth; but the lateral incisors stand out before the under teeth.

"The third variety is, when the central incisors are placed properly, but the lateral incisors stand very much in; and when the mouth is shut, the under teeth project before them and keep them backwards.

"The fourth is, when all the incisors of the upper jaw are turned, and those of the under jaw shut before them. This is sometimes occasioned by too

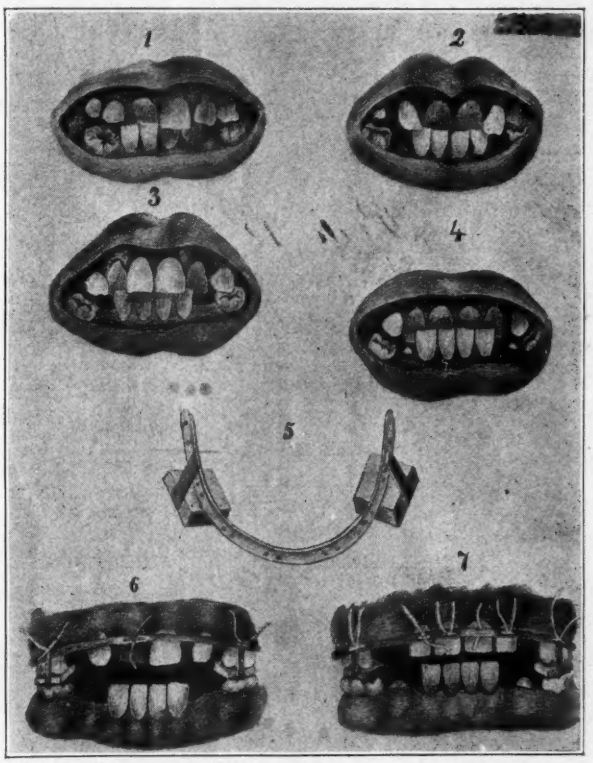


Fig. 4.—Appliance devised by Fox, for correcting irregularities of the teeth. Original drawings, Surgeon-General's Library, Washington, D. C.

great a length of the under jaw, in consequence of which it projects considerably more forward than the upper jaw. But the majority of such cases originate entirely from neglect, and may be completely remedied by early assistance.

"To remove the kind of irregularity above mentioned, two objects must be accomplished; one, to apply a force which shall act constantly upon the irregular tooth, and bring it forward; the other, to remove the obstruction which the under teeth by coming before the upper always occasioned.

"The first of these objects may be attained by the application of an instrument adapted to the arch of the mouth, which being attached to some strong teeth on each side, will furnish a fixed point in front, to which a ligature previously fastened on the irregular tooth may be applied, and thus, by occasion-

ally renewing it, a constant pressure is preserved, and the tooth may be drawn forward.

"The second object, that of removing the resistance of the under teeth, must be attained by placing some intervening substance between the teeth of the upper and under jaws, so as to prevent them from completely closing, and be an obstruction to the coming forward of the irregular tooth.

"The instrument may be made of gold or silver, it should be so strong as not easily to bend; if about a sixteenth of an inch in breadth, and of proportionate thickness, it will be sufficiently firm. The bar of gold must be bent to the form of the mouth, and should be long enough to reach to the temporary molars, which are the teeth to which it is to be tied. Holes are to be drilled in at those places where ligatures are required, which will be on the parts opposite to the teeth designed to be the fixed points, and also at the parts opposite to the place where the irregular tooth or teeth are situated then to the bar a small square piece of ivory is to be connected, by means of a little piece of gold, which may be fastened to the ivory and the bar by two rivets. This piece of ivory passes under the grinding surfaces of the upper teeth, is kept there fixed, and prevents the teeth from closing and consequently takes off all obstruction in front.

"The bar is to be attached by a strong silk ligature to the teeth at all sides so that if possible it may remain tight as long as it is required; a ligature is then to be tied around the irregular tooth, and the ends, being brought through the holes in the bar, are to be tied in a firm knot. In two or three days this ligature must be removed and a new one applied; the tooth will soon be perceived to move. A fresh ligature must be used every three or four days, in order to keep up a constant pressure, sufficiently powerful to bring the tooth into a line with the others.

"The same mode of treatment is to be observed whether there be one, two, or three teeth growing in a similar manner. The teeth are usually brought forward in about a month or five weeks, and as soon as they are so much advanced as to allow the under teeth to pass on the inside, the piece of ivory may be removed, and the bar only be retained for a few days, until the teeth are perfectly firm, which will prevent the accident of the teeth again receding.

"In cases where the irregularity has been suffered to continue too long, no success can be expected to follow attempts to remove it; we must content ourselves in the treatment of these cases in adults, with taking away the most irregular teeth, and thus, as much as possible, lessen the deformity."

J. R. Duval (1805), a prolific writer, called attention to the causes of irregularities of the teeth and their treatment as early as 1805. "The conformation of the face almost always determines the order of the teeth, when it is flat and square, the jaw presents the contour almost circular while the teeth are planted with more regularity; on the contrary, when the face is straight and projecting in the middle as if the head had been squeezed at its sides, the jaw presents the form of the extremity of an oval and does not offer sufficient room for the arrangement of the teeth, hence we have mouths which seem to have a double row of teeth, if the dentist has not early watched the cutting of the in-

cisors, or if he has not sacrificed secondary incisors, canine or grinders . . . it is usually called a gag-tooth, or wolves tooth."

His method and reasons for extraction were as follows: "Those which are most frequently out of their places are the canine of the upper and lower jaws, the deformity which results from this deviation might promptly determine us to extract them if we were not aware that they are less susceptible of caries than the small grinders which are in contact with them, and therefore, we ought to sacrifice the latter, and preserve the canine, which are more visible when a person laughs or speaks; for although at first they may be far from the place which they ought to occupy, they will arrange themselves more readily when the obstacle is removed, especially if they are often pressed with the finger according to the advice of Celsus, a celebrated physician of the Augustine Age. We should also take away one of the small grinders if it be irregular which is, however, more rare, and less urgent with regard to the appearance."

In the correction of the teeth, Duval cautions against the use of the file, seldom recommending this method of procedure. "Equal prudence should also be used in the employment of gold wire or silk for altering the position of irregular teeth; the irritation, pain and loosening, which it is almost necessary to produce, shows the necessity of caution, as well as in the use of gold bars, and forceps which are sometimes used for the same purpose, art proposes the means, the dentist should weigh well the advantage and disadvantages, the success at the time speaks much in their favor, but how many have to complain (though too late it is true) of having paid dearly for a few weeks of beauty."

Duval was perhaps the first to note the importance of the relation of upper and lower jaws. "It is not sufficient that the teeth are properly arranged, by the side of each other, those of the upper jaw, have a special connection with those of the lower, the least deviation from which diminishes the beauty of the appearance, frequently renders their functions laborious, and may often tend to their mutual destruction. Thus the superior incisors pass over the inferior and imitate in their action the cutting of a pair of scissors; in general the more parallel they are when brought into contact, the more they communicate to the face the character of beauty.

"The more the incisors recede from that parallel line, the more they diminish the graces of the visage and of the mouth; we sometimes see a projecting chin, and the teeth both of the upper and lower jaw are turned inwards, towards the tongue, and we sometimes find a white singularly disfigured, by the teeth projecting outwards, which is supposed to constitute the beauty of the mouth of a negro. Against these two deformities which proceed from the conformation of the jaws, art is not able to offer any sufficient resources.

"Sometimes the incisors of the lower jaw pass before those of the upper. In this deformity, we must not expect that art will be equally effective, especially after the teeth are renewed and the eight large grinders are cut, there exists between the corresponding surfaces of the teeth of the two jaws, a disposition which does not easily change or if such change should be effected disagreeable consequences may ensue; the most proper time is that when there are no more than eight secondary incisors.

"If art can be of any service in either of these cases, it must consist in facilitating the diminution of the dental arch by the extraction of an incisor; but can we warrant the success of this operation and at what age, and upon which tooth ought it to be performed? Let us use caution here, and rather content ourselves by rectifying certain deviated incisors, which gives the appearance of a projecting chin."

In the correction of these deformities Duval recommends the method of Fox's and the use of the inclined planes. He also speaks of a guttered plate, which has been in use for over twenty years, but fails to describe or illustrate same. Delabarre describes it "as a sort of small inclined die, which, placed over the tooth that has deviated to the exterior, is disposed of in such a way, as to strike, at every occlusion of the mouth, the teeth that meet it." Talma later mentions the same appliance describing it as "a gold or platina plate, with which the lower circle is cased, and which is fashioned in the shape of an inverted groove or gutter and fastened on either side to the molar teeth. Here is the beginning of our present method of anchorage."

M. Miel (1808) first directed attention to changes produced by the teeth of the lower border of the inferior maxilla. He showed that the lower border of the inferior maxillary bone is slightly arched upwards, and backwards, in the child and older person, but that it is perfectly horizontal in the adult.

The fact of the equality of length of the anterior portion of the dental arch, before and after the shedding of the teeth, was effectively proved by Hunter and M. Miel; although its invariability, during all the process of second dentition was not made out by these authors. This, however, has been perfectly established by M. Oudet, in a paper which he read in 1824.

"M. Miel, who gave considerable attention to this subject, and who warmly defended the opinion of Hunter, adds: 'The appearance of the second teeth is but a substitution of those which are longer and more capable of effecting the uses of a more vigorous age; their total volume is the same as that of the temporary teeth, the only difference is in their respective size.' Another circumstance, upon which M. Miel lays great stress with much reason, is that the teeth of those persons in whom the second dentition is premature, are not placed regularly in the arch, but are pressed up against each other."

Catalan (1808) illustrated and described the principle of the inclined plane for moving interlocked upper incisors into lines as then used, although used prior to this time and mentioned by other authors,—Hunter and Duval. It was made of a long narrow band of gold or silver passing along the labial surface of the lower, metal clasps or projections were soldered to the band and bent inward at points opposite the malposed tooth of the upper so that in occluding, this tooth would be forced outward. These metal inclines rested on the cutting edge of the lower incisors in order to resist the strain.

This appliance was used to a great extent for many years, greatly improved and claimed by a number of authors as originating with them, although described prior to Catalan's time, many mentioning the use of same.

John Fuller (1810) attributes irregularity to too long persistence of temporary teeth; he also says that the upper jaw is too small for the permanent teeth, which fact often occasions irregularity. "Some children have the habit

of projecting the under jaw forward, and, of course, shutting one or more of the under front teeth beyond the upper, which soon becomes permanent."

Joseph Murphy (1811) in *"A Natural History of the Human Teeth,"* speaks of irregularities due chiefly to the first teeth not having been shed in time, supernumeraries and another cause. Murphy, as well as all his predecessors and those that followed him devoted considerable discussion to the "projecting chin" and advocates the extraction of teeth in the correction of same. In those cases with protruding anterior teeth he made use of a bow or spring of gold wire, with flat hooks fixed upon the incisors and the ends of the spring drawn down and tied to the molars at each side.

He also advocated the use of wood, flattened and used as a lever.

"It is now pretty generally known that children's teeth may be regulated

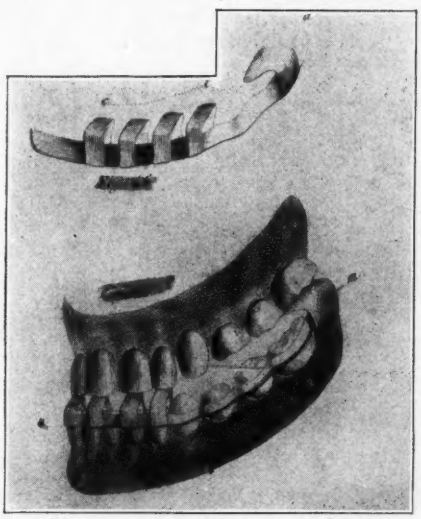


Fig. 5.—Appliance used in time of Catalan and credited to him, although in use prior to his time.

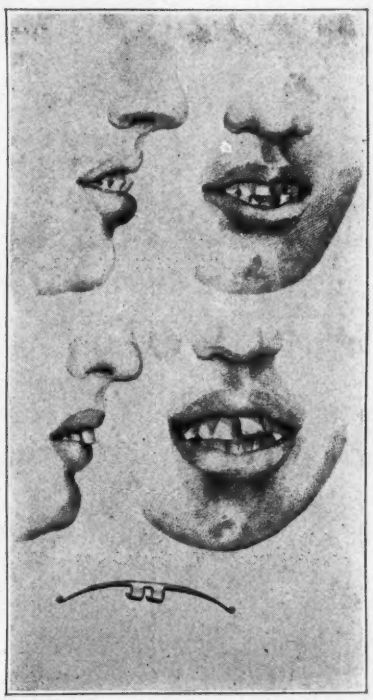


Fig. 6.—Appliance used by Joseph Murphy to correct deformity of the teeth. The four figures illustrate the various positions of the teeth and jaws as described by Fox.

in their growth, so as to prevent irregularities; but it is of the greatest importance that the regularity of children's teeth may be entrusted to proper and skillful hands; incurable deformities and loss of teeth are too often the consequence of improper treatment.

"The influence of the teeth, in giving form and expression to the human face, is much more considerable than is generally supposed.

"The symmetry and beauty of the oval of the countenance depend entirely upon the form of the mouth and chin; the form of the latter is determined by the shape of the jaw bones, and the regularity of the teeth; both of which may be greatly influenced by the mechanical pressure.

"The annexed plate represents a few cases drawn from nature, which were regulated and reduced to symmetry.

"The most remarkable effects produced on the countenance by irregular positions of the teeth, are the projecting chin, and the prominency of the two front teeth of the upper jaw, commonly called the rabbit mouth. There are many other deformities occasioned by irregularities of the teeth, but of less importance than these. They are generally caused by the first teeth not being shed in time to make room for the second; the latter consequently take irregular positions; and when suffered to remain in this order, until the teeth of

Fig. 7.—Title page, "Treatise on the Management of the Teeth," Benjamin James, 1814. One of the few illustrated title pages of dental books.

the upper, and those of the under jaw have come into irregular contact with each other, the deformity becomes established.

"The projecting chin is frequently a consequence of the causal irregularity."

Benjamin James (1814) wrote in a *"Treatise on the Management of the Human Teeth."* "With proper attention paid to the removal of the first set of teeth, the regularity of the second may be anticipated. . . . The jaw of a person very young is so soft and yielding that a tooth taken out at a considerable distance from a deranged tooth makes room for it, the teeth on each side of the one extracted crowding in to fill up the vacancy. But when the jaw has become more hard and unyielding, we can make room for the deranged teeth only by drawing those in immediate contact with them. Then, by gentle compression of the finger applied daily for several weeks to the deranged tooth, we see it come into its proper place as effectually as from ligatures, spring, or violence.

"The sides of the upper teeth touch only at that point which is most distant from the gum, for this reason noxious accumulations between the upper teeth cannot be so easily removed as between the lower teeth. It is therefore, in the power of the file to destroy the greater aptness of the upper teeth to decay." We thus note the beginning of preventive treatment for decay.

Charles Bew (1819). From the time of Hunter until Bew little attention was paid to the occlusion of the teeth and the importance of maintaining same. Bew, in 1819, called particular attention to this most important subject of our work as follows: "By the arrangement here offered it will be seen that nature as if to guard her work from injury by close contact had so planned the situation of the teeth, that no single tooth should in fact press solely upon the other, but in the powerful triangular ratio of one to two, and even in this, the power appears to be admirably settled for the general economy, by being confined to the sides.

"For an examination of the central incisors if the information be perfect the impression of the teeth is made by the overhanging of the upper jaw, passing in a slanting direction upon the notched surfaces of the under incisors, the cuspidati performing the same action. The bicuspids occilauti the preparation of food for the stomach by the addition of a double lateral action, as the *Mitre Like Forms* of the upper bicuspids are made to sink into the corresponding cavities of the lower bicuspids.

"The good effects resulting from attention to the teeth in the earliest stages, even to lengthened existence, is so abundant in advantage as to require agreement for the enforcing of the necessity.

"Enough has been said and seen of the propriety of proper attention being paid to the primary teeth for the better arrangement of the permanent set.

"If the permanent teeth are arched in their progress they will arrange in the most perfect order when many of the attendant evils which I have described in this work, will be happily obviated. As it is often found much easier to prevent than cure a disease, so it is more advisable to avoid deformity, by subjecting the child to the trifling pain and gradual loss of one or two teeth in a month, during dentition, than to reserve them by dozens, for the *coup de main* of the dentist: who is not only often reluctantly compelled to leave the habitation for a time tenantless, but to sting the thoughtless parents, by the promulgation of an evil out of his power to eradicate."

Delabarre in his work on *"Second Dentition"* (1819), devoted considerable space to the subject. He described for the first time in 1815 (*Odontologische Beobachtugen,* Paris) the use of metallic caps, or crowns, for the rotation of teeth; until then the practice was to use a notched hickory, by the use of silk ligatures passed around the tooth and tied, thus turning the tooth, applying same daily, although Fanchard described how this was accomplished in one sitting. The appliance consisted of a metal box or crown, molded to the exact form of the tooth, with a threaded tube soldered end-wise to the crown. A piece of gold wire bent nearly at right angles and threaded was screwed into this tube; the other end contained a loop. The spring of the wire on being bent down and tied to the teeth, rotated the tooth.

For the purpose of keeping the antagonizing teeth apart he devised the

first wire crib, a device which later proved of great use as an anchorage. This was later modified by Schange and others. It consisted of six pieces of gold wire bent and soldered together, forced over the teeth, and closely fitting the teeth at the gingival border.

To the writings of Delabarre we are probably more greatly indebted than to any of his contemporaries; while many of his ideas were wrong, a great many were correct. I therefore believe it wise to quote a part of his work in this paper, first, to show the knowledge he had of the subject, and second, as a valuable lesson to all.

"The authors of nosology and physiology devote even some lines to them

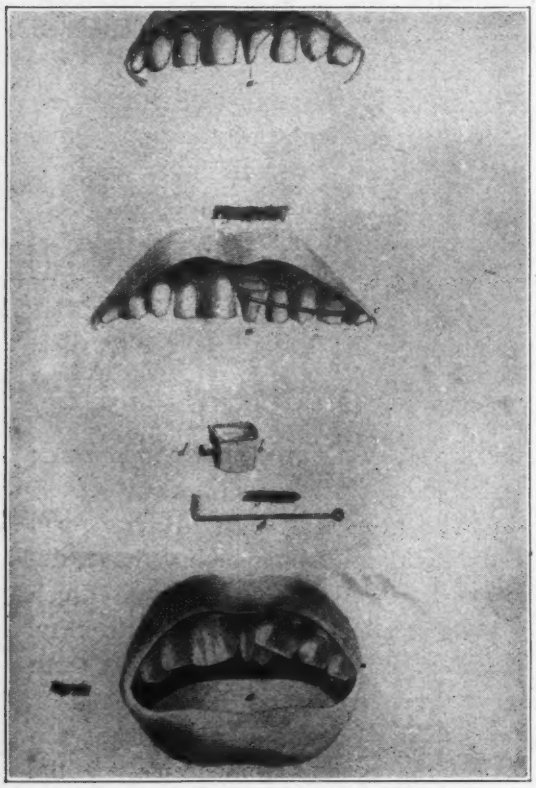


Fig. 8.—Appliance used by Delabarre to rotate anterior teeth showing, perhaps, the first crown, and tube (threaded) to be used in orthodontia.

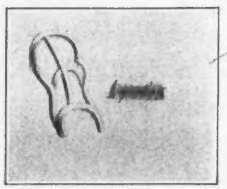


Fig. 9.—First wire crib, Delabarre.

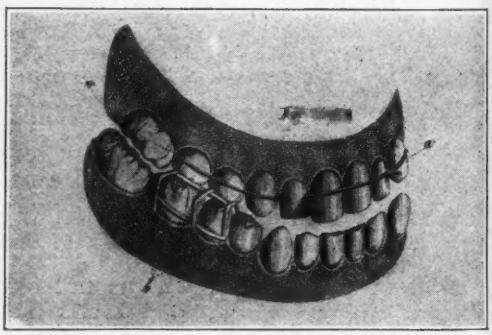


Fig. 10.—Showing crib adjusted to the teeth.

but they appear to mention them only to complete the plan of their works, and thus they have treated them only very superficially. Many, indeed, though freely confessing the great want of knowledge, of the expansion, growth and disease of the teeth, are nevertheless, by reason of their numerous engagements, unable to devote themselves to their study.

"Formerly, these bones were regarded, indeed, as mere ornaments of the face, and consequently their preservation was rather the province of the perfumer than the regular physician.

"Men of approved medical knowledge, however, have had first dentition under their inspection, but it is not thus with the branch we are now consider-

ing. This has been left to the observation and sagacity of the dentists possessing not the requisite physiological knowledge.

"The laws that govern the expansion, growth, and arrangement of the teeth are properly the patrimony of the physician, who should understand them in order to direct the dentist whenever (which unfortunately is too frequently the case) he is not furnished with sufficient information on all the duties of his profession.

"It is very desirable that there should be a class of physicians, who would give their attention to the practice for the diseases of the mouth; this is the only means of preventing so interesting a part of our art from falling into the hands of mere practitioners, or from becoming the prey of the vilest charlatans. Such persons cannot practice any part of surgery without detriment to society.

"These principles may be applied to the treatment of second dentition; it is much easier to extract teeth, than to determine whether it is absolutely necessary. The extraction of a tooth requires nothing more, on the part of the practitioner, than a certain degree of facility in the use of instruments that are usually employed in this operation; whilst the knowledge necessary to appreciate the consequences can only be acquired by time and study.

"Although the utility of a work in which the different opinions of these authors should be impartially discussed, has, for many years, appeared incontestible, and although I have collected many notes on this subject, yet believing the task was too great for me, I have for a long time hesitated to arrange them. Nevertheless, the necessity of instructing our young practitioners on the choice of means to regulate second dentition, has triumphed over the repugnance I have felt to attach received opinions, and a mode of treatment sanctioned by time and supported by the most celebrated authors.

"In order, therefore, to contend with success against so great authorities I must be read without prejudice, and by those who will be disposed to examine the physiological facts that I oppose those theories which I think proper to controvert. I ought, accordingly, before presenting the natural method for aiding the arrangement of the dental arch at the time of moulding the primitive or temporary teeth, to review the phenomena displayed in the formation of the second teeth, as well as in the progressive enlargement of the jaw, until the termination of the second dentition.

"*Natural Method of Directing the Arrangement of the Adult Teeth.*—Since the progressive eruption of each series of teeth is one of the laws ordained by the Creator, why have so many authors on dentistry endeavored, by the spirit of the systems, to follow a different course? Why do we find so many dentes excerti among children of the wealthy class whose dentition meets with the more attention, while they are of so rare occurrence among the indigent that have very little recourse to professional aid, but rely upon the goodness of nature. Is not a part of those vicious dentitions, which we so frequently meet with in society, owing to the unsound system adopted by dentists? Is not their system founded rather on faulty reasoning than on the study of the anatomy and physiology of the mouth and jaws? These are questions which I shall endeavor to resolve, while giving a general view of the system adopted and recommended by men whose works are in very great repute.

"It is, therefore, indispensable to examine dentition under its different aspects, in order to aid nature only when she of herself, is unable to accomplish her task. It is, then, only that the physician is neither to be a slave of systems, prejudices, or routines, or opposed to the operations of changes that he cannot foresee; the end to which the surgeon aims; it is the proper adjustment of the adult teeth; but can he effect this only by the evulsion of the temporaries?

"Have authors on dental surgery taken cognizance of the constant and natural imbrication of the teeth during their formation? Have they ascertained, that as the teeth of replacement are below the gums, there cannot be any contact between them and the temporaries, and have they from this understood that these last cannot prevent the eruption of the other, except at the moment in which this contact becomes possible? Have they observed that ingenious means employed by nature to destroy the teeth, whose presence ceases to be useful? It appears to me that none of them have examined these various questions; for they then would have seen, that their system is essentially vicious; they would have perceived that the more the temporary teeth are removed the more the jaws contract, instead of their being by this means, necessarily assisted, and as it were forced to increase.

"The natural method, that I am about to explain, differs essentially from this; for, according to it, the presence of the temporary teeth is considered necessary, until a determined epoch, and here all the care of the surgeon only tends to favor the increase of the maxillary circle; it never shows, that, whatever be the width of the replacing teeth, and even if their number be greater than it usually is, they will always have a tendency to be well arranged provided the maxillary arc is proportionally expanded, whether by natural or artificial means.

"But it is very essential to know that there are in certain individuals, predispositions that will prevent or retard the development of the maxillary bones; and which will, whatever be the system we follow, and how small so ever be the teeth, deprive us of the satisfaction of seeing them well arranged. Consequently the physician should ascertain, by inspecting the subject, if second dentition can be performed with ease, which he may presume may be the cause whenever he meets with facts below enumerated.

"First. When a child of about seven years, on whom the temporary teeth are loosened, is of good constitution—has not had any severe disease in the first three or four months of its life—and all its members are well developed.

"Second. When the jaws assume a form rather circular than elliptical—the primitive teeth present a good arrangement—the palate does not describe the triangular arc, but offers a flattened and regular concavity; the inferior jaw does not project beyond the superior.

"Third. When the temporary teeth are rather large than small, and are rather separated from each other than crowded together.

"Fourth. When the teeth, primitively crowded, after a time separated; which in effect may be observed from the age of four to five years old, and is a certain indication that the jaw assumes its increase.

"Fifth. When this separation is effected with harmony and simultaneously on both jaws; for, if it only occurs on one, and especially if on the inferior jaw, we should find that the opposive denture would be prominent.

"Sixth. When, between five and six years, we see four permanent molars appearing, in whose dimensions there is nothing extraordinary for, in the contrary case, we should presume that all those that are to come after them, will share this excess of size.

"Seventh. When between the ages of seven and eight years, the temporary incisors gradually loosen, and on putting the finger within the mouth no jutting points are perceived, because then it is presumable that the teeth of replacement are forced below the temporary roots and will determine their complete absorption.

"Eighth. When the teeth are ready to be moulded, are found pushed before or raised by those that are to be replaced by them, and which immediately show themselves from below.

"Ninth. When all the temporary have been maintained, each in its place, and no disease has occasioned its premature evulsion or loss.

"Tenth. When the natural loosening and moulding of the temporary teeth take place in the order and at the usual epoch for shedding each series of teeth in the human species; an order and epoch which we have before noticed.

"The physician should be careful to ascertain whether the jaws of the infant have any hereditary tendency to assume particular forms, for we sometimes as I have said before, meet with a family, all of whose dentures describe exactly the same arc; which contributes not a little to establish a resemblance in their physiognomies. It is also proper that he should know how to distinguish the three ordinary positions of the inferior maxillary bones relative to those of the superior.

"Thus, 1st, when the chin is short and the superior jaw well arched, the series of the six superior teeth passes before the six inferior, somewhat like the blades of a scissor.

"Second. When the chin is a little longer, and the teeth are short, the two dentures fall plumb upon each other without crossing.

"Third. If the chin is very long and the superior maxillary be but little depressed in its anterior arc, the six inferior teeth pass before the superior, like that which may be observed on dogs and some kinds of apes.

"Finally, there is a species of torsion of one or both of the jaws, which causes the superior anterior temporaries on one side of the median line, to fall outside of the inferiors, according to the right disposition, whilst the similar teeth on the other side of the same line drop within the inferiors; if in such a case the difficulty is not obviated it is probable that there will be a similar disposition in second dentition.

"After having completed this preliminary examination, the physician should make his prognosis, and inform the parents of what peculiarity the denture of the child will present, in order that the irregularity that may result, and which he cannot prevent, may not be imputed to him.

"Though in certain embarrassing circumstances where there was a vice of conformation, I thought advisable to make some modifications in the method that I am now describing, still I believe that it should seldom be varied.

"If it happens that a canine precede the bicuspids, I, in consequence, am

led to extract them, whose looseness turn me from what I, otherwise, would have done.

"According to the method I have just described, it is only necessary that the surgeon-dentist, should, for the most part, be a tranquil observer of the shedding of the teeth; for the temporaries frequently fall out of themselves, and when he thinks that they ought to aid nature we see that he should extract only one tooth at a time, whose place may be supplied by another; so that in following this course, he will not notch the denture of a subject, when any of the adult have failed, as they frequently do to be developed.

"Thus, this method is founded on the principle that each of all the temporaries, before they are replaced by an equal number of adult teeth, does not form any true obstacle, except at the moment in which that which is to succeed it begins to appear, and instead of the neighboring teeth being considered as opposing the arrangement of the one that arrives and endeavors to intercalate itself between the others, they should be regarded as affording solid parieties against which this tooth may be supported, forcing thus the jaw to be increased; but if this effort does not follow, I think it right to employ mechanical force to produce it, especially if the child has been in good season deprived of some of the temporary teeth, or even if we perceive that those of replacement, being too much pressed by their neighbors whose time of moulding has not yet come, threaten to preserve that vicious obliquity which they affect. Thus, in a very great number of cases, I have obtained this enlargement, with the aid of a thread, which having been twisted around the temporary and adult teeth, becoming swelled by the humidity of the mouth soon brings to its proper place of the tooth that appears to be about to take the wrong direction. This is a simple process, and when the dentist has once or twice placed the ligature in the presence of an intelligent person, he may entrust to him the task of its removal. At other times, small wedges of wood have been employed with like success. In general the traction should be gradual so as to give the maxillary bones time to yield to its impulses.

"We must not lose sight of this physiological principle, that, by drawing a tooth away from one side, the alveolus is enlarged, and a slight swelling developed that occasions a supportable disquietude, which degenerates into pain, if the sensibility of the parts has not been treated with skill; it is therefore, necessary to allow nutrition sufficient time to effect the absorption of the alveolus on the side to which the tooth is to be carried; whilst the opposite wall will approach it, and the osseous juices supplied from exhalation by filling up the vacuum render a deviation impossible.

"The deviations of teeth of the ordinary size are very common to feeble children, on whom the absorption of the temporary roots is generally effected with difficulty, and the increase of whose maxillary circle is very backward.

"Deviations caused by the excessive size of the teeth, unaccompanied by a vice in the conformation of the jaws, are likewise of frequent occurrence and require different operations, according to the different cases.

"When each tooth is only a little too large, we should, before employing the traction of threads, file between the several teeth, we may by this means obtain from the whole, the space of a third, or a fourth of a tooth than cut the

rest too much, when the size of these bones appears to be extraordinary, and especially if there exists the least defect in the conformation of the jaw. When the fault is very decided, I find it more prudent to remove the teeth out of the row than to attempt to bring them within the circle. As the rest, we should never be in haste to make their evulsions, for the jaw sometimes increases when we least expect it; so that instead of there having been a sacrifice of several, which it was supposed must one day be removed; that of one also has frequently been sufficient; while we are thus temporizing, therefore we are only courting favorable opportunity. I never have had occasion to regret acting in this way, even when I have refused the reiterated requests of the persons that were charged with the children found in this condition.

"It is, consequently, only after having been perfectly satisfied, that the teeth which are badly arranged can never be rectified, that I attempt to remove them, and I usually practice this operation about the age of twelve or thirteen years; for then the anterior arc of the jaw is susceptible of but little increase.

"In other circumstances when one desires to regulate the denture by removing the teeth, he should extract some in preference to others, thus all dentists agree to sacrifice a small lateral or central incisor that is wholly out of the row; the same may be said of the conoids when in a similar situation, unless the bicuspids be diseased; but we should generally prefer to remove one of these, in order to make room for a canine or conoid, that we believe can be brought back with facility.

"When I, from the arrangement, am led to believe that a small gap must result from the indispensable sacrifice of a tooth, I prefer to remove the second bicuspid, to facilitate the placing of the conoid; but then it is necessary to bring back the first bicuspid, by means of a thread that draws it towards the great molar. In this way a void space will be found in the anterior of the mouth.

"The evulsion of the first great molar affected with caries, appears to me to be but little capable of favoring the arrangement of a conoid, though it may be useful in assisting that of a tardy bicuspid. All these cases demand care, and may compromise the reputation that has not decided with sound judgment.

"There are, nevertheless, two exceptions to this sort of general rule, relative to the following cases.

"First. When the jaws of a child, which are still adorned with first dentition, present the defect which causes them somewhat to resemble a shoe.

"Second. When the vicious contraction of the upper jaw is such, that there is no hope that it can be corrected.

"Then my practice is as follows: I remove as soon as they appear, one or two small inferior central incisors of replacement; this operation in some degree arrests the development of the lower jaw, which it was found would be left to project beyond the superior; and as the other teeth gradually shoot up, I draw them towards the median line and there detain them by means of a thread. Though fully convinced of the delicacy of this operation, and the responsibility hanging on my reputation, I have performed it twice and with complete success.

"It will be seen, that in the two cases above cited, I readily sacrificed teeth that had just come up, without waiting until dentition was terminated, for then

the vicious development of the jaw would have been completed, which on the contrary, it is very essential to prevent.

"It has been my good fortune, several times to bring back without sacrificing a single tooth, two conoids that had shot entirely without the circular line, in consequence of the bad management that had been used at the time of the removal of the denture, and which suspended the development of the alveolar circle; but before I commenced these important operations, I was always well assured that there was no defect in the conformation of the jaws, that the teeth were only of the ordinary breadth, and finally, that the subject was not more than eighteen years old. Thus, whatever may be the cause of the deviation of the teeth it is always accompanied by a relative contraction of the alveolar circle; but is it by removing the milk teeth that this will be ever enlarged? And it is well established that we may determine the increase of the jaw, by attracting to it a greater quantity of nutrition; should we hesitate to have recourse to this means?

"Let us, therefore, know how to derive advantage from our physiological knowledge in giving an agreeable contour to the face; but let us not, at the same time, forget that the vices of conformation, to which it has not in time applied its resources, should frequently be respected, that the efforts which we make to correct them may, by disappointing our expectations, be prejudicial to the subject.

" 'Would that the ideas of the beautiful and marvelous did not so much mislead us,' says the judicious Duval, on this subject.

"Still, if the defect of the conformation of the jaw be scarcely sensible, if, moreover, the teeth be rather small than large, and rather separated than crowded, we may then, with good hope of success, act as in cases of simple deviations, caused by a want of development, this is what is more frequently met with in the superior than the inferior jaw.

"From the observations (whence it is clearly shown that the problem to be solved is the increasing of the jaw, when this is not effected by nature herself), we must admit that the sacrifices have recourse to the last resort of extracting the adult teeth only when there is no longer any hope of the increase, destroying or diminishing the defects; and mechanical means, skillfully employed, have been of no effect.

"The irregularity of the teeth presents other facts equally as wonderful; thus, we sometimes meet with a tooth, whose lateral face is turned to the lips; we may also now and then observe one, whose inclined part of lingual face is entirely turned to the side opposite to that where it should be; there are some, too, which shoot up very high in the gum, or very low in the palate.

"How very responsible is that precipitation, which drives some dentists to extract those teeth that have sprung up contrary to nature, since, in preventing one deformity, they frequently occasion another.

"I have seen several subjects, from whom teeth that had come up in this manner were extracted, and who, in consequence were forever after without the right number of teeth. We should thus act, only when the tooth is evidently one of those supernumeraries called intercally teeth.

"Still, I do not advise to leave them in the situation in which they present themselves; the art is not destitute of proper means to correct these defects.

"When one of the six anterior has been completely turned around, we may make it perform a rotary movement on its axis by applying on its crown a sort of die, moulded in the exact form of the tooth, previously isolated from the rest by the aid of a file.

"We cannot without interest see this small machine, which I have always employed with success, whenever a case of this nature has been presented in my practice.

"There are also transpositions of the germs, which cause us now and then to observe a small incisor in the place of a great one, or a canine in the place of a small incisor. Fox has had several of these aberrations engraved; M. Miel recently presented two such instances to the Medical Society of Emulation.

"I have several times seen two teeth placed one before the other, though they both belonged to the same dentition; in a similar case, I found two small incisors, neither of which were within the circle, and one of them was a supernumerary. I was, therefore, very much embarrassed in deciding which of them ought to be sacrificed, for the true supernumerary generally has a shorter root than the other, whilst, on the contrary, its crown is frequently very good.

"I have observed still another variety, which consists in this, that the temporary conoids remain in the row, though the cuspidati and bicuspids of replacement have come up, and are well arranged in their proper order (between the first permanent molars and temporary cuspidati), so that the young person, whose mouth presents this peculiarity, has four very sound cuspidati, (in one jaw), and this without there being any defect in the dental arch. You may readily believe that, in such a case, I advised that not a single tooth should be extracted.

"I will not here attempt to describe all the various machines that have been invented to correct the different deviations of the teeth, but only those that are in use at present, and recommended by men of merit.

"In all these cases, the consequences of which it is prudent to foresee, advice should be given to shorten the teeth that are of more than ordinary length. As to the rest, I cannot too often repeat, that this operation, is not injurious to the teeth on which it is performed, whether with a file or with an excising forceps.

"From what I have just said, which is only the result of rigorous experience, it appears that the file, when prudently used, is not a dangerous instrument to the teeth, its employment is sometimes useless, but never occasioned the loss of these organs.

"If the beautiful arrangement and regularity of the teeth give grace to the physiognomy, they are still of so much more importance to the health, that we cannot too much promote or determine these. When there is a proper symmetry in the two dental circles they fall plumb upon each other, and mastication is performed with ease, but if any tooth is out of the row, and strikes the corresponding one, it renders it painful and loosens it."

We thus note the careful study and excellent advice Delabarre gave to his

fellow practitioners. Were this advice and study followed today how much better off would our little friends be.

Here we also find the first relation of the inferior and superior maxillæ and an attempt at a classification of this subject, the beginning of the system later simplified and modified by Dr. Angle.

The Eastern Association of Angle Graduates

THE Seventh Annual Meeting of the *Eastern Association of Graduates of the Angle School of Orthodontia* was held May 5th and 6th at the Vanderbilt Hotel, New York City. The following very interesting papers were read:

"DIET AND THE TOOTH BRUSH." By *Dr. A. W. Crosby, New Haven, Conn.* A short digest of some of Pickerill's ideas on the relation of diet to caries and a composite reflection of thoughts expressed on the subject in recent literature.

"THE ROLE OF MOUTH INFECTION AND MOUTH ABNORMALITIES IN THE CAUSATION OF DISEASE." By *Eugene Lyman Fisk, M.D., Director of Hygiene, Life Extension Institute, New York.*

"THE RELATION OF MASTICATION TO NASAL BREATHING." By *Dr. John Kepke, Brooklyn, N. Y.*

"A STUDY OF THE NORMAL MOVEMENT OF THE PERMANENT TEETH DURING THE COURSE OF ERUPTION." By *Dr. H. C. Ferris, New York.* Surveys of consecutive models made during the transition period from the deciduous to the permanent denture, showing the relative positions of the permanent teeth, and illustrating the value of the geometrical method in the study of developmental changes.

"ATYPICAL DEVELOPMENT IN THE LIGHT OF CORRELATIVE VARIATIONS." By *George E. Dawson, Ph.D.* Organic evolution reveals a tendency of structural variations to appear in groups. The development of individual forms of life reveals a similar tendency. This is true both of normal and of abnormal variations. Anomalies of the human organism, therefore, should be regarded in the light of this law of group-variation. The corrective treatment of such anomalies should take into account the entire complex of structures and functions with which the anomalies are correlated. This involves, in reality, the entire organism, but it affects more immediately the closely related structures.

"CASE HISTORIES WHICH ILLUSTRATE THE INTEGRATIVE ACTION OF THE NERVOUS SYSTEM." By *Dr. J. V. Mershon, Philadelphia, Pa.*

"DYNAMICAL FACTORS INVOLVED IN THE ETIOLOGY OF MALOCCLUSION." By *Dr. J. G. Lane, Philadelphia, Pa.* An analytical study, from the dynamical point of view of the forces directly responsible for the different types of malocclusion, in contradistinction to the tendency of many writers upon Etiology to consider conditions so remote as to be far beyond the operative field of orthodontia.

"THE DEVELOPMENT AND ANOMALIES OF THE MAXILLÆ FROM THE STANDPOINT OF BIOLOGY." By *Dr. E. A. Shuman, Springfield, Mass.*

The following clinics were given: *Dr. E. Santley Butler,* "A LOCK APPLIANCE FOR THE TREATMENT OF DECIDUOUS OR MIXED DENTURES;" *Dr. J. H. Worthen,* "LINGUAL ATTACHMENT FOR SIMPLE EXPANSION," "PRECISION .030 MARKER," "INSTANTANEOUS CLAMP FOR JIG;" *Dr. W. S. Watson,* "RECORD KEEPING," "PHOTOGRAPHY;" *Dr. H. A. Pullen; Dr. H. K. Hatfield.*

DEPARTMENT OF
DENTAL AND ORAL RADIOGRAPHY

JAMES DAVID MCCOY, D.D.S., EDITOR,
LOS ANGELES, CALIF.

THE INTERPRETATION OF DENTAL AND ORAL RADIOGRAPHS

BY JAMES D. MCCOY, D.D.S., LOS ANGELES, CALIF.

Professor of Orthodontia and Radiography, College of Dentistry, University of Southern California, Los Angeles, Calif.

THE ability to correctly interpret dental and oral radiographs is an accomplishment which every dentist should possess. In fact, it should be viewed not only in the light of an accomplishment, but as a requisite of modern dentistry. It is to be acquired by practical experience which must have for its foundation, *first, a thorough knowledge of the anatomy of the parts involved; second, a familiarity with the appearance in the radiograph of the dental and oral structures under normal conditions; and, third, a knowledge of the pathological conditions which may develop in these structures, and the character of the anatomical changes which they bring about.*

We should keep in mind the fact that radiographs are shadow pictures, and that the effect produced by the x-ray upon the photographic plate is but a shadowgraphic representation of the tissues through which the rays have passed. As this ray penetrates all matter in inverse ratio to its mass or density, the shadow picture which is left upon the photographic plate is simply a record of the varying density of the tissues through which the rays have penetrated.

The x-ray is particularly applicable to the dental and oral structures, owing to the fact that *these structures differ sufficiently in degree of density to permit of their appearing in a characteristic manner upon the photographic plate.* For instance, it will be noted upon the examination of a dental radiograph, that metallic fillings, if they are present, appear as white masses, and root fillings as somewhat less white lines. The enamel and dentin are next in density, while root canals show plainly as dark channels in the dentin, and the alveolar process and maxillæ show their fine uniform cancellous structure in various degrees of density depending upon their thickness.

Because the structures within the field of our specialty have *a characteristic appearance under normal conditions, any alterations or change in these structures is at once evident upon the plate,* thus affording us a means of studying *intra vitam* the gross pathology of the structures of the oral cavity.

Fig. 1.—This radiograph shows an impacted upper third molar. The outline of the antrum is also plainly visible above the molars and bicuspids.

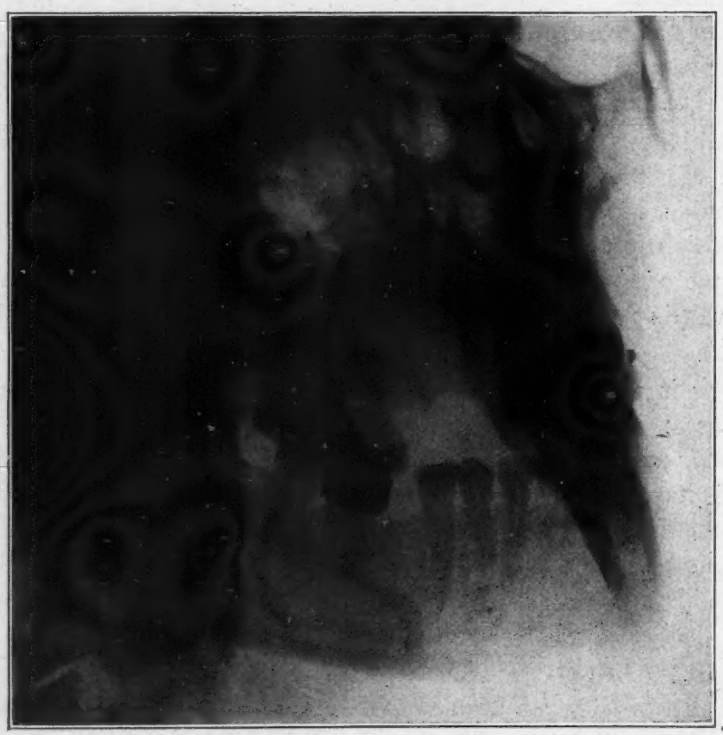


Fig. 2.—A cuspid tooth lying against the anterior wall of the antrum. It will be noted that the cuspid is inverted in its position.

THE EXAMINATIONS OF RADIOGRAPHS.

Dentists often underestimate the value of radiographs because their opinion is based upon their appearance either in halftone engravings or after their transference upon lantern slides. As such they should never be judged, as much of their diagnostic value is lost when reduced to this state.

Fig. 3.—A supernumerary second bicuspid. Upon the extraction of the second bicuspid in place at the time the radiograph was made, the "supernumerary" erupted, and was found to be typical in size and form.

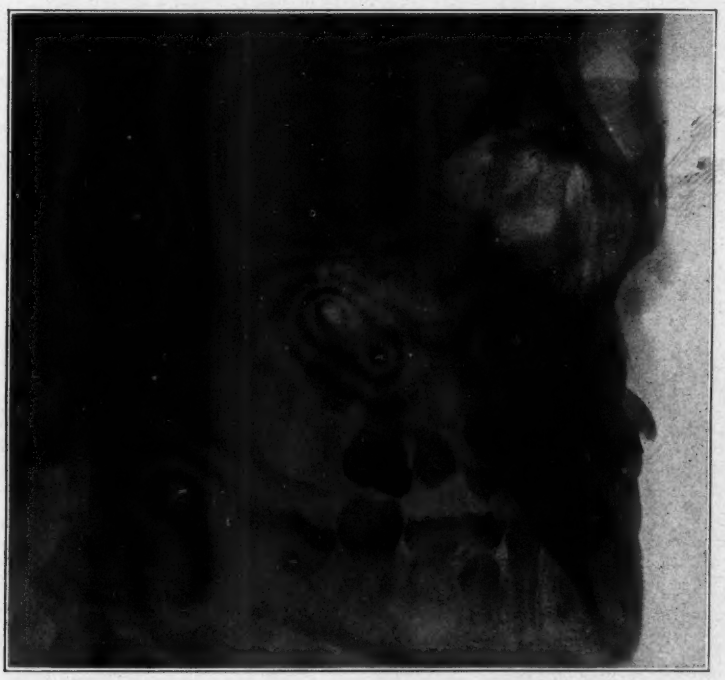


Fig. 4.—A radiograph to determine the state of dentition of the right side in the mouth of a child eleven years old. The developing second molars are shown, likewise the upper second bicuspid, cuspid, and the lower first bicuspid about to erupt. It will be noted that the lower second deciduous molar has no successor, nor is there an upper first bicuspid present in the jaw.

The original negative itself should be examined carefully and in a proper light. This is best accomplished by the use of an "illuminating" box or cabinet. Such a cabinet should contain several electric lamps, and the current entering these lamps should be controlled by a rheostat, or some other means, by which the intensity of the light may be changed at the will of the operator.

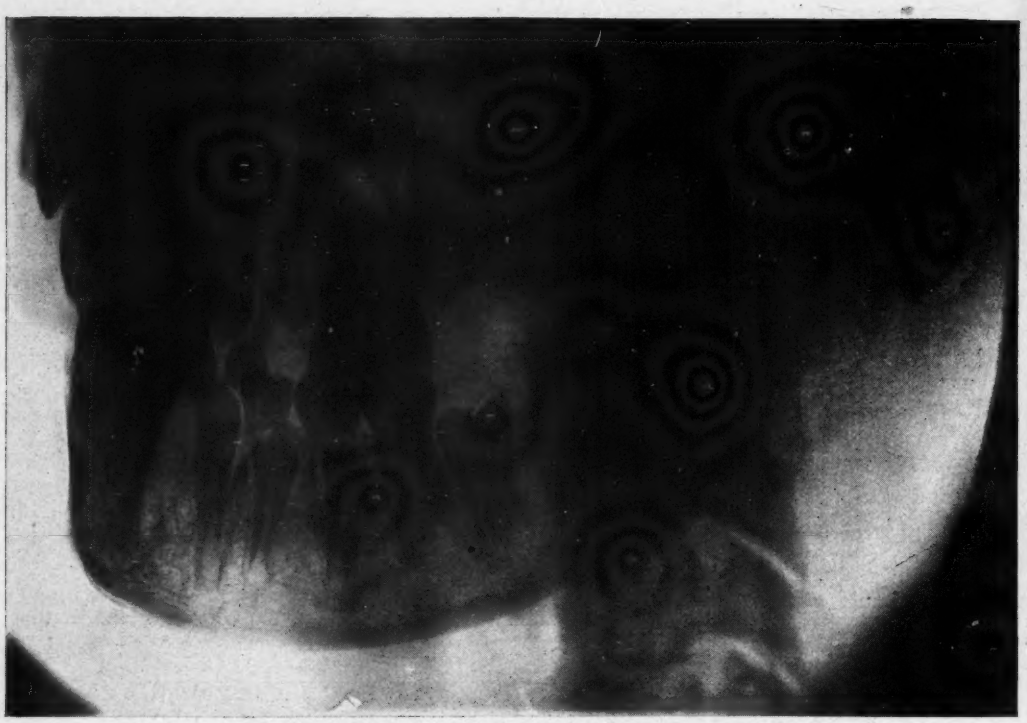


Fig. 5.—The successors to the deciduous teeth are shown, as well as developing second and third molars.

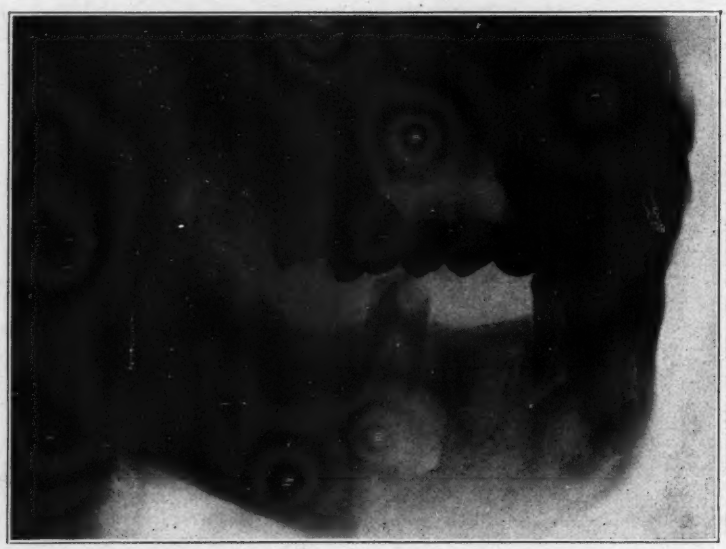


Fig. 6.—A very large alveolar abscess is visible below the mesial root of a lower molar.

causing it to start with a very dim light and gradually increase until a brilliant illumination is produced and vice versa. The face of this cabinet should be covered with ground glass so that the light will be free from shadows and equally distributed. An opaque mat with an opening the exact size of the plate under examination, should be placed over the ground glass so that the vision is not distributed by the light escaping from around the edge of the plate or

Fig. 7.—An alveolar abscess involving the roots of an upper central incisor and lateral incisor. No root canal fillings are present in either tooth.

Fig. 8.—An abscess is visible between the central and lateral incisors. Its origin could be due to either tooth or perhaps to both.

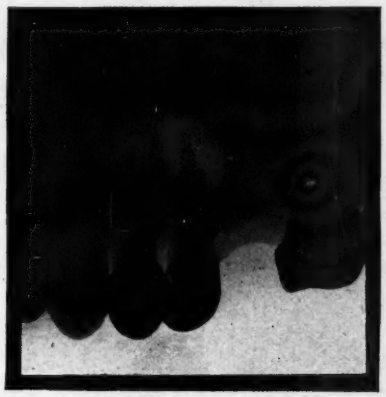


Fig. 9.—There is evidence of a small alveolar abscess about the apex of the root of the first bicuspid, while a larger one is shown to exist about the root of the second bicuspid.

Fig. 10.—Alveolar abscesses above two bicuspid teeth. The relationship of the abscess areas to the antrum is also shown.

Fig. 11.—Large alveolar abscess, chronic in character, about the apex of upper first bicuspid.

Fig. 12.—Large alveolar abscesses emanating from the upper lateral incisor and extending to the adjacent central incisor and cuspid.

film. Only by using a cabinet can radiographs be examined and interpreted to the very greatest advantage.

To one who has never seen a negative illuminated in this manner, the effect is almost startling in its beauty. As the x-ray negative is a transparency, a dim light behind it will bring out one set of shadows to their greatest clearness; an increase in the light will show forth still other effects, while a still

greater illumination will bring out the more dense portions of the negative, and in this way by varying the light in the illuminating box, each portion of the negative may be studied under a degree of light to bring out the maximum amount of detail.

Now with a print or lantern slide one can examine the field from only *a one light aspect,* and oftentimes in order to secure any degree of detail in the lighter or less dense areas, it will be found that the dense areas must be

Fig. 13.—Chronic alveolar abscess cystic in character, above an upper lateral incisor. Root filling material forced through the end of the root is plainly visible.

Fig. 14.—*A.* An upper bicuspid tooth with an alveolar abscess at its root apex. It will be noted that the root canal is improperly filled.

B. Shows the same tooth about two months after it was treated and the root canal properly filled. The rarified area about the apex has greatly decreased in size.

C. Shows the same tooth about six weeks later. The abscess area has entirely disappeared and the bone structure about the apex appears to be normal.

printed almost to an inky blackness. It should be obvious, therefore, that a single-phase print, or a negative, examined under ordinary conditions, cannot approach the various and comprehensive effects which are brought out by means of an illuminating cabinet.

In examining intra-oral radiographs, it is an advantage to place them in a film mount which will hold them securely and render it unnecessary to view

them while being held between the fingers. Such a "mount" should preferably be made of celluloid with one side clear and the other side dull, which allows the light transmitted to be of the same character as that coming through ground glass.

In examining negatives, we should bear in mind the fact *that very dense tissues are characterized by white areas,* while *less dense tissues appear darker,*

Fig. 15.—A necrotic area lying below a lower cuspid. It will be noted that there is not a distinct and abrupt line of demarcation between the light area and its surrounding tissue as is the case with alveolar abscesses, but the area gradually shades off from light into dark.

Fig. 16.—An area of necrosis about the roots of a lower first molar.

and the absence of tissue is indicated by blackness. To avoid confusion, we should remember that *in prints and lantern slides this color spectacle is reversed.*

Assuming now that we are familiar with the normal appearance of the dental structures under the x-ray, let us now consider some of the variations from their normal appearance which are found in the presence of pathological conditions.

As a tooth is much more dense than the bony structures of the jaw, any anomaly of form, size or position in the jaws is easily discernible even though it occupy a position far from what might be expected, as for instance, in the case of impacted molars, teeth in the antrum, etc. (See Figs. 1, 2 and 3.)

Fig. 17.—Small wires introduced into root canals to determine their length or the extent to which they have been opened, are easily differentiated from root canal fillings or tooth structure.

Fig. 18.—Root canal filling material forced beyond the root apex of an upper second bicuspid.

Likewise and for the same reason the presence in or absence from the jaws of successors of the deciduous teeth can easily be determined, as shown in Figs. 4 and 5.

Fractured roots or fractures of the bone even without displacement are often discernible at the line of fracture, owing to the fact that the line of fracture offers less resistance to the penetration of the rays and therefore is apparent upon the plate as a dark line.

Where an abscess takes place in the alveolar process, there is always an accompanying destruction of the cancellous bone tissue. Knowing that the absence of tissue is indicated upon the plate by a very dark or black area, such an area would indicate an alveolar abscess. "In fact, where these dark areas

are found in the alveolar process, *and are not natural cavities,* such as the antrii, or the nasal cavities, or such well defined nerve openings as the mental foramina, and where they are *markedly circumscribed,* that is, having a distinct and abrupt line of demarcation between the dark area and its surrounding tissues, we can in nearly every case, even if a clinical history be lacking, make the positive diagnosis of alveolar abscess." (See Figs. 6, 7, 8, 9, 10, 11, 12, 13, 14.)

Necrosis likewise appears upon the plate as a dark area, but differs in a

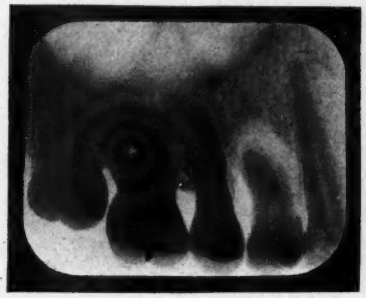


Fig. 19.—An abscess involving the pericemental and alveolar tissues about an upper first bicuspid.

Fig. 20.—An osteo-sarcoma of the mandible.

characteristic way from the ordinary alveolar abscess in that it is not circumscribed, *namely, that there is not a distinct and abrupt line of demarcation between the dark area and its surrounding tissue,* as is the case with the circumscribed infections, but *the area gradually shades off from dark into light,* portraying the progressive characteristics of this disease. (See Figs. 15 and 16.)

The different filling materials vary but little in the relative graduation of their shadows. Oxychloride, gutta-percha, and cement have about the same density, and when used as root filling materials, are plainly visible as light lines. Because they differ in density from cementum and dentine, the extent to which

they have been introduced into the root canals is easily discernible. Broken-off broaches and other instruments, or small wires introduced into root canals to determine their length or the extent to which they have been opened, because of their great density, appear very white and are easily differentiated from root-canal fillings or tooth structure. (Figs. 17 and 18.)

Where a destructive process has ensued in the peridental membrane, or in the bony wall of the alveolus (pyorrhea pockets) and is present on the mesial or distal side of a tooth, these conditions appear upon the plate as dark areas owing to the fact that the rays pass through them more easily, and effect the emulsion of the plate to a greater degree than if normal bone structure is present. The approximate extent of the destructive process is therefore easily determined. (Fig. 19.)

Cysts and tumors of the maxilla or mandible, owing to the fact that the character of the changes they bring about renders the areas involved less dense, their extent is visible upon the plate as a dark area. (Fig. 20.)

In seeking out the various anomalies and pathological conditions to which the teeth and oral structures are subject, *we should not be misled by indefinite shadows upon x-ray plates.* The very nature of these structures, their gross as well as minute anatomy, renders them somewhat difficult to radiograph, and necessitates a refinement of technic greater than that demanded with most of the other portions of the human anatomy. *Therefore, only radiographs made in accordance with a definite and exacting technic should be relied upon for diagnosis. If a doubt exists in any given instance, an additional or even several more exposures should be made, so that any conclusion reached will be founded upon definite evidence.*

Orthodontia and the General Physical Health

BERNHARD WOLF WEINBERGER (New York Medical Journal, April 22, 1916) discusses more particularly the subject of malocclusion, with reference to its etiology, effects, and treatment, and concludes that modern orthodontia requires a thorough knowledge of the physiological development of the dental arches and associated structures, the remote as well as the local etiological factors; proper diagnosis, classification, and treatment, based not only upon mechanical principles, but on physiological principles as well. A study of normal occlusion teaches that the full complement of teeth is absolutely necessary in order that the teeth may perform their proper function; extraction of teeth to accomplish this result is not only unnecessary but even criminal. Where the dental arches are arrested in their development, the development of the associated structures is also hindered. Therefore the orthodontist is dependent upon the rhinologist, and the rhinologist needs the assistance of the orthodontist. The disturbances of development begin early in life, consequently orthodontic treatment should be begun early, in order that cure may be completed by the time the second molars are in their proper position. Marked facial deformities can be corrected, allowing every child to develop normally, permitting functions of nutrition, digestion, and respiration.

ORAL SEPSIS AS A FOCUS OF INFECTION *

Its Bacteriological, Dental and Roentgenological Aspects

By Byron C. Darling, A.B., M.D., New York

Instructor in Orthopedics, College of Physicians and Surgeons, New York; Roentgenologist, St. Vincent's, and Ruptured and Crippled Hospitals.

THE roentgenologist occupies an unique position between the physician and the dentist in his obligation to their patients. In cases of gastro-intestinal lesions, urinary calculi, and fractures, the physician or surgeon may be expected to know more of the condition than does the roentgenologist, and it remains only for the roentgenologist to interpret his findings to them. In the field of oral surgery, however, both physician and dentist may learn of the roentgenologist.

The radiograph, properly interpreted, is practically infallible in oral conditions. To no branch of the medical profession is the need of oral prophylaxis more evident than it is to the roentgenologist; I believe it, therefore, to be his duty and well within his professional province to teach and demonstrate to the medical and dental professions, and through them to the public, that oral sepsis is a focus of infection and a menace to the community.

Medical literature, along this line since 1911, is most interesting, and has been increasingly so since 1913. It remained largely for Rosenow to connect the focus with the systemic condition and to identify the bacteria present. This he has done until he is able to claim that the following list of diseases could originate in oral sepsis: arthritis,[12, 13, 14] myositis, neuritis, neuralgia, and migraine; myocarditis,[19] endocarditis,[14, 15, 16] nephritis, and thyroiditis; gastric and duodenal ulcers,[17] cholecystitis, appendicitis, and such obscure diseases as Hodgkin's disease, the leukæmias, and pernicious anæmia.[11] Over twelve years ago Rosenow, with the cooperation of Billings, began experiments on animals to prove this connection between the focus and the infection. His writings are so fascinating that the originals should be read.

In 1914, Dr. Thomas B. Hartzell[3] confirmed Rosenow's experiments. He sums up the work of Rosenow in these words:

"During a series of studies lasting over eleven years, Rosenow has shown that streptococci found in the mouth or tonsils can be made, under suitable conditions,[18] to change into typical and encapsulated lanceolate pneumococci, capable of causing rapid and virulent pneumococcemia; or under other cultural conditions to produce organisms which determine in the joints, causing arthritis deformans; and under still different cultural conditions to produce streptococcus viridans, which is the characteristic organism in heart valve lesions; and under still other cultural conditions to become capable of causing ulcers of the stomach and bowels. In animals, Dr. Rosenow has experimentally brought about heart lesions. Recovering his organism from the heart lesions and comparing it with the injected strain, he has in turn caused ulcer of the

*Read before the American Roentgen Ray Association, at Atlantic City, September 23, 1915.

Reprinted by special permission from *The American Journal of Rontgenology*, March, 1916; copyright by Paul G. Hoeber, Publisher, New York City, N. Y.

stomach. Recovering his organism from the ulcer of the stomach and comparing it with the original strain, he has caused joint infections. Again he recovered his organism from the joint, and has been able to produce typical pneumonia with an organism which originally was a harmless inhabitant of the mouth, and subsequently to recover from the diseased lung the original strain."

Referring to the alveolar abscess (Figs. 1-6), Dr. Hartzell says:

"In addition to osmosis occurring from the pockets and abscesses, we have

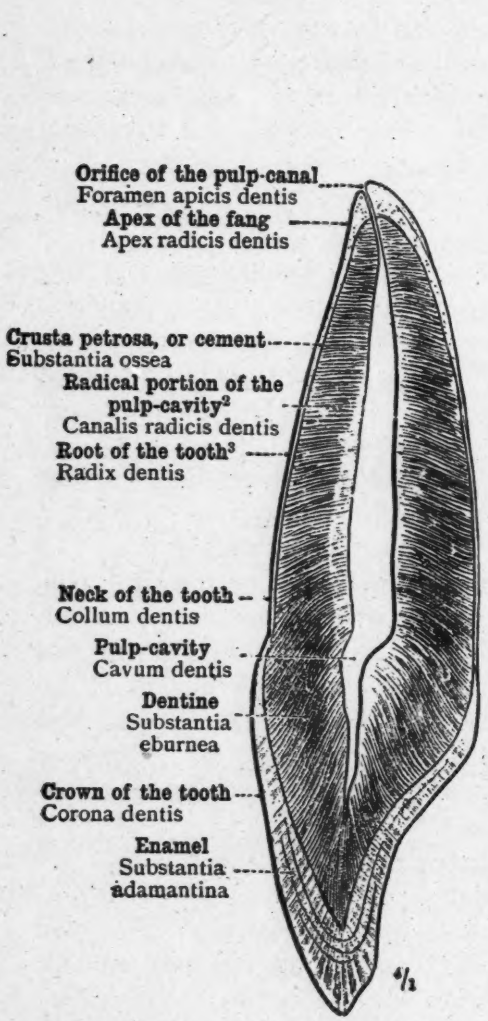


Fig. 1.

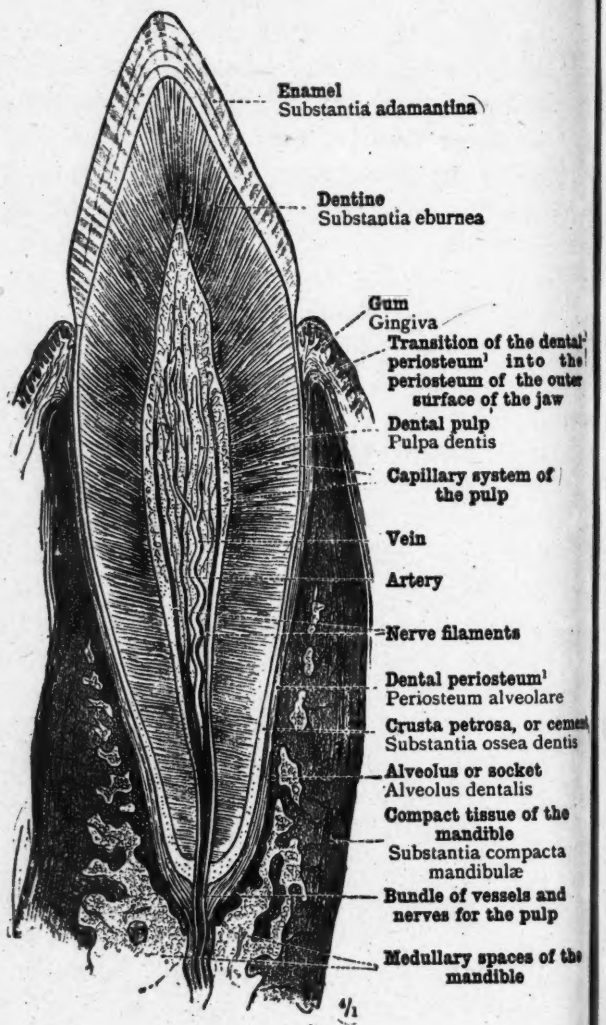


Fig. 2.

Fig. 1.—Anatomy of the normal upper central or mesial incisor tooth in the sagittal section, the dentine, the enamel, the cement. (From Toldt's "Anatomy.")

Fig. 2.—Anatomy of the lower canine tooth with its pulp chamber, blood and nerve supply, alveolar process, periosteum (pericementum) and gum margin. (From Toldt's "Anatomy.")

the enormous force of occlusion to hasten the exchange of fluids between the lesion and the circulation. The pressure of occlusion acts as a piston pump against the peri-apical abscess and the lesion around the root (Fig. 6), applying by a pumplike action thousands of pounds in the course of twenty-four hours, thus hastening ordinary absorption."

Such investigations as these enabled Dr. Charles H. Mayo to say that "the

Fig. 3.*—Dry specimen (child): The normal alveolar process closely surrounds necks of teeth, roots, and apices. Here several teeth have as yet blunt, uniformed apices.

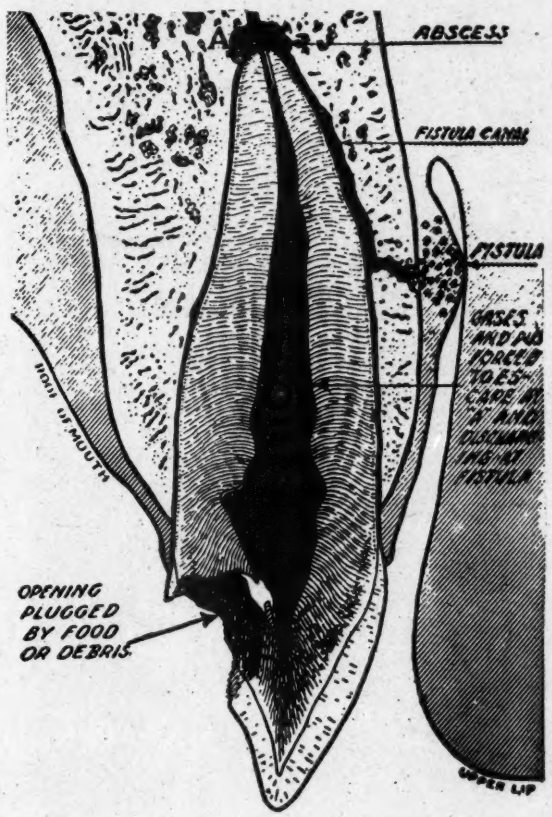


Fig. 4.—Diagram: The usual blind abscess (apical osteitis) has developed the less common fistula and gumboil. Compare Figs. 1, 2, 3, and 5. (Diagram by courtesy of the Ransom & Randolph Co.)

next great step in preventive medicine must be made by the dentists;"[6] and he adds, "Will the dentists make that step?"

The earliest writings I have found are those of Dr. Benjamin Rush of

*For permission to reproduce Figures 3-11 the author is indebted to the *Medical Record*.

Fig. 5.—Dry specimen: 1 and 1*a*. Decay of canine. Infection extending to the apex produced large area of necrosis anterior to the antrum. 2. Alveolar absorption from pyorrhea. Other teeth likewise. Compare with Fig. 6.

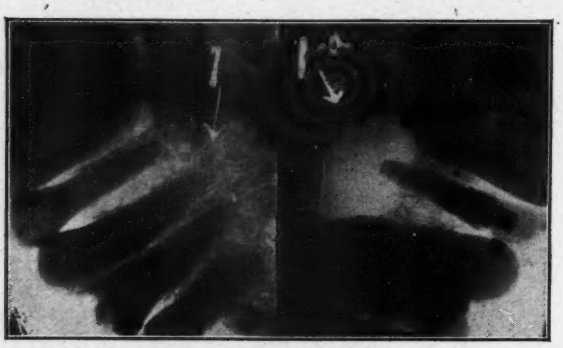


Fig. 6.—X-ray in the living: 1. Normal side showing cancellated bone detail. 1*a*. Large apical abscess (osteitis) following porcelain crown and pivot; infection caused by failure to empty and fill the canal. Such "whited sepulchres" must become diseased. Compare with Figs. 1, 2, 3, 4 and 5.

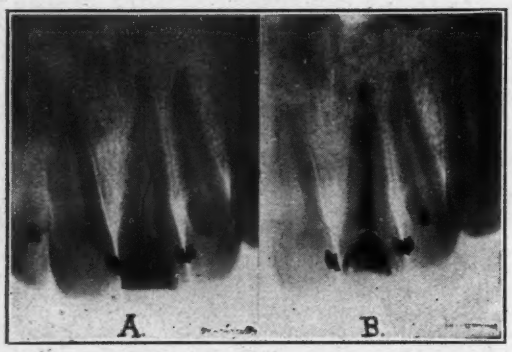


Fig. 7.—*A*. Tooth with wire in root, showing that the canal has been emptied (aseptically) to the end. *B*. Same tooth, showing root canal filled to the end. (Dr. R. Ottolengui.) Compare with Figs. 4, 5, 6 and 14.

Philadelphia, who said in his book, Volume 1 of "Medical Inquiries and Observations," as follows:

"Some time in the month of October, 1801, I attended Miss A. C. with a rheumatism in her hip joint, which yielded, for a while, to the several remedies

for that disease. In the month of November it returned with great violence, accompanied with a severe toothache. Suspecting the rheumatic affection was excited by the pain in her tooth, which was decayed, I directed it to be extracted. The rheumatism immediately left her hip and she recovered in a few days. She has continued ever since to be free from it.

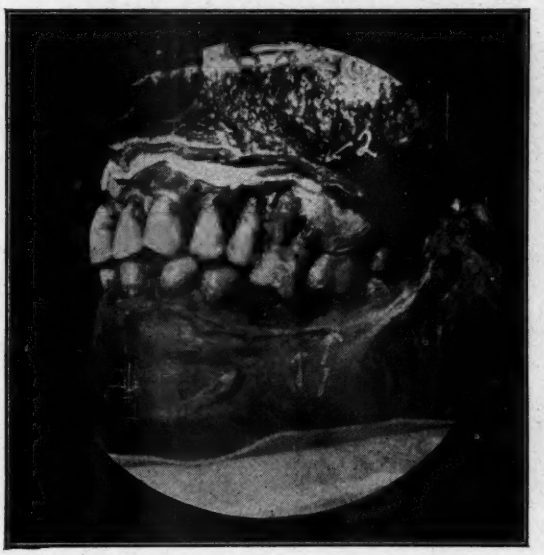


Fig. 8.—Wet specimen: 1. Lower jaw. Snags or roots, a frequent source of apical osteitis. 2. Upper jaw. Extensive pyorrhea (Riggs' disease). Note the receded ulcerated gum, due to disease and absorption of the alveolar process beneath. Compare with Figs. 2, 3, 9, 10, 11 and 12 (1 and 4).

Fig. 9.—Dry specimen: Stripping of all the teeth from alveolar absorption, especially the molars, which have become loose foreign bodies. Compare with Figs. 2, 3, 8, 10, 11 and 12.

"When we consider how often the teeth, when decayed, are exposed to irritation from hot and cold drinks, and ailments, from pressure by mastication, and from the cold air, and how intimate the connection of the mouth is with the whole system, I am disposed to believe that they are often the unsuspected

causes of general, and particularly of nervous, diseases. When we add to the list of those diseases the morbid effects of the acrid and putrid matters which are sometimes discharged from carious teeth, or from ulcers in the gums created by them, also the influence which both have in preventing perfect mastication, and the connection of that animal function with good health, I cannot help thinking that our success in the treatment of all chronic diseases would be very

Fig. 10.—X-ray in the living: Extreme stripping from pyorrhea (Riggs' disease). Even ends of the roots, as well as the entire alveolar processes, are absorbed. Note the unclean bridge on the lower front incisors. Compare with Figs. 2, 3, 5, 8 and 9.

Fig. 11.—X-ray in the living: Long history of arthritis. 3 and 4.—Crowned teeth with root canals not filled, showing slight apical osteitis. 5, 6, and 7.—Crowned fifteen years; roots completely stripped from alveolar absorption (pyorrhea) or from extension of apical osteitis; canals never emptied or filled. 8.—Root lost through disease. Compare with Figs. 2, 3, 5, 9 and 13 (1, 3 and 4).

much promoted, by directing our inquiries into the state of the teeth of sick people, and by advising their extraction in every case in which they are decayed. It is not necessary that they should be attended with pain, in order to produce diseases, for splinters, tumors and other irritants before mentioned often bring on disease and death, when they give no pain, and are unsuspected

as causes of them. This translation of sensation and motion to parts remote from the place where impressions are made appears in many instances and seems to depend upon an original law of the animal economy."

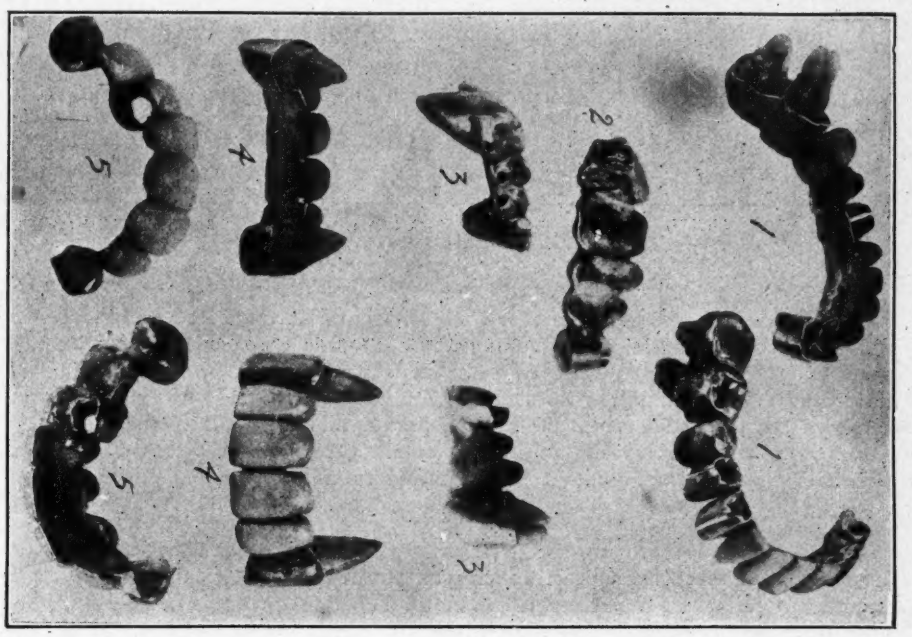


Fig. 12.

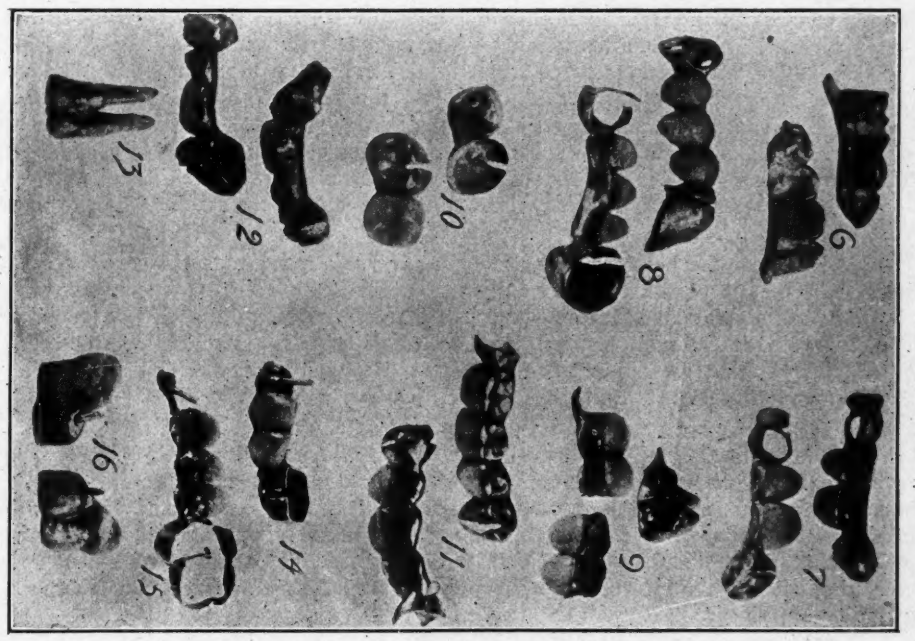


Fig. 13.

Although, as early as 1887, Alfred Mentel, of England, had pointed out the relationship between the tonsils and rheumatic fever, and had proven that the tonsil is a path of entrance of the streptococcus to the blood stream, and although, over forty-three years ago, Pasteur established infectious bacteria as

the specific source of disease, our contemporary literature on oral sepsis as a focus of infection dates back only fifteen years. When, in 1910, William Hunter,[4] of London, definitely pointed out septic dentistry as a possible source of disease, the medical profession paid little attention to it. More emphatically again in *The London Lancet* of January, 1911,[4] Hunter came out with his expression "American Dentistry." (Figs. 6, 10, 11, 12, 13 and 14.) This article, badly abstracted in *Current Literature,* aroused and stimulated American dentists, and marked the date of the beginning of their serious and keen work of investigation and experimentation.

PROSTHODONTIA.

SPECIMENS OF WORK FROM PROMINENT MEN.

These specimens are not the work of all-around incompetents: authors, clinicians, professors of prosthodontia figure among those at whose doors the existence of these specimens may be laid; men who, in some instances, are not so painstaking, that they fill the root canals of multiple-rooted teeth with gold-foil, then crown these teeth in the manner here shown, and execute the bridgework in this faulty fashion. The more carefully one examines these specimens in full detail, the firmer grows the conviction that such work is empirical and without any scientific foundation.

FIG. 12.

Figs. 1, 2 and 3 represent the aftermath of what a certain patient carried in his oral cavity, placed there by a practitioner who considers himself, and is considered by a great many, to be above the average in the skilled construction of bridgework. It will be noted that the crowns do not come within an eighth of an inch of fitting the necks from superficial examination the phonetic deficiency of the appliance must be apparent. In order to support the four lower incisors the practitioner restored to the fixation of the entire number of lower teeth, and thus defeated his purpose and the patient's well-being of the pier teeth; that no attention has been paid to contour labio-lingually; that even by robbing all of his lower teeth of the essential individual tooth motion. The necessity for interdental space was entirely ignored, and the occlusal surfaces of the two upper pieces, right and left, show nothing short of charlatanism. The square of the surface left to accumulate filth is equal to the squares of both surfaces, labial and occlusal respectively, so that while the two latter are kept automatically clean, one by the cheeks and the other by the work of trituration, the one that cannot be automatically cleaned was made the largest in area. Why?

Fig. 4. From the hands of the same master craftsman: note the quarter of an inch deficiency in the fit of what the practitioner undoubtedly called a cuspid crown. Note the lack of labio-palatal restoration, and hence interference with proper enunciation, and also please observe the final loss of the piers. Let us pass on to the next one with the thankful thought that we did not compound the felony by copartnership in the specimens so far shown.

Fig. 5. Particular attention is called to Fig. 5. An anterior bridge running back on the left side to the second bicuspid; on the right side, ditto. From every point of view, one of the worst examples of bridgework and a foul insult to a patient's intelligence, as well as a death blow to anyone's good health, constructed by one of New York's greatest porcelain specialists, actually doing work for the dental profession. It is surmised that the skill he displayed manifested itself in the addition of a little porcelain to the gingival borders of the teeth—a trap for filth and an everlasting shame for the man guilty of this product.

Compare with Figs. 10 and 11.

FIG. 13.

Fig. 6. This is shown in order to bring out the contention that bridgework, as it is being practiced, is a chaotic jumble. The practitioner who is responsible for this specimen is a clinician of national reputation, when it comes to filling root canals with gold foil. The specimen shows considerable knowledge of root preparation and absolute lack

of proper relation and of labio-lingual restoration. It is the half knowledge that seals the fate of a piece of bridge work, even before it is put to any test; here we find no occlusion and no evidence of knowledge of the physics or dynamics of bridgework.

Fig. 7. A piece of rigid lower bridgework—may the gods forgive me for giving it the name! It shows an absolute lack of any of the knowledge with gold foil. The specimen shows considerable of this kind. Please note the lack of occlusal provision; lack of the sense of preparation; lack of interdental spaces, and pray consider that at one time there was a man who tried to collect a royalty from every man practicing bridgework, for he claimed it as his invention; and then reflect upon the fact that Fig. 7 is the creation, the handiwork of his first assistant. One may by an insignificant stretch of one's imagination see a blue line emanating from Fig. 7, and if one looks intently enough upon the blue line it will curl into the letters which make up the words, "The patient be damned!"

Fig. 8. This is shown to illustrate the lack of knowledge of the simple fact that if a tooth be divided into three equal parts, gingivo-morsally, its greatest circumference is at the gingival plane of the morsal third, and its smallest diameter at the gingival plane of the gingival third. The rest of Fig. 8 is of no further interest, because it lacks anything which would entitle it to serious consideration, if it were not that it has been responsible for the development and growth of X million bacteria and the loss of a sound molar tooth. This was constructed by one who seriously takes himself as an expert crown and bridge worker.

Fig. 9. This shows an intelligent (?) attempt to restore two teeth by a method of slotting the artificial fixture and running it upon a supposed-to-be parallel bar. No allowance is made for vertical stress; none for latero-rotary stress; the labio-lingual restoration is faulty, and the method of procuring distal anchorage is mechanically unsound. Like a dutiful specimen it came back to tell of all the discomfort it had caused its proud (?) and glad (?) possessor during a period of a short six months or so. Its creator: a president of a dental something or other, a clinician of State reputation; an expert with Ascher's enamel, etc.

Fig. 10. This shows a more comprehensive knowledge of crown construction and was made by a professor of prosthetic dentistry in a western institution. Presented because it exhibits the folly of attempting to obtain union between crown and dummy anywhere except upon the mesio-morsal and disto-morsal lines respectively; had this been done in the specimen here submitted the interdental space would not have been encroached upon, the area would not have become severely inflamed, and the work might yet have been in the oral cavity; though the gingival part of the facial palatal restoration was decidedly wrong.

Fig. 11. A failure of the better class, and perhaps responsible for keeping this infernal bridgework alive so long. Constructed by a so-called topnotcher—yea, with an office on Fifth Avenue. Further remarks would be uncharitable. Let the specimen speak for itself.

Fig. 12. A vile example of a Sixth Avenue dental fakir. This is commonly called bridgework, and while it looks "fierce," as Myra Kelly would have said, in mechanics it is no worse than a good many of the specimens submitted earlier.

Fig. 13. Two Richmond crowns showing a great deal of care in construction, a knowledge of what was required, but evidently an impossibility of execution. Hence failure resulted, due directly to an ill-fitting band and consequent peridental irritation. Nevertheless, the effort of a conscientious workman.

Figs. 14 and 15. Specimens from one of Hubbard's Immortals showing such a lamentable lack of knowledge that a summary of their faults will suffice:

(1) Lack of knowledge of tooth preparation.
(2) Lack of knowledge of importance of interdental space.
(3) Lack of knowledge of proportionate size of teeth.
(4) Improper labio-lingual restorations.
(5) Ignoring vulnerability of soft tissues of buccal cavity.
(6) Uncleansable area twice as large as cleansable one.
(7) The result of all the foregoing was a year of unspeakable torture for the patient, now fully restored.

Fig. 16. A central and lateral incisor carried on pivot, insufficient to support one tooth, yet asked to support two. The piece shows an absolute disregard of all the rules

that should govern the construction of such work, and yet the man responsible for it is a porcelain specialist of New York City, and enjoys a national reputation. If it were possible to reproduce colors in the illustration, it would show an enviable amount of ignorance of the laws that govern the production of colors; enviable, since they say that ignorance is bliss. It is needless to say that the duration of the appliance was just about the time that elapses between two rooster crows, and such is a specimen of time-honored and long-heralded porcelain bridgework.

A sufficient number of examples has been shown to compel the conclusion that the schools and colleges for dentistry are deficient, or such specimens could not exist. The methods for conveying the scientific, the accurate, the absolute in dentistry, the methods of teaching this character of work, are wrong because they are constructed upon false foundations, and no amount of trimming will bring them into plumb.

The writings of roentgenologists on the subject are few, but emphasize the diagnostic value of radiography to the dental profession; as, for example, Pfahler, in *Roentgen Rays in Dentistry,* 1909;[8] Lange, in an article just previous to it; and MacKee, in *The X-Ray in General Dentistry,* 1913.[6]

The medical profession was not then alive to tonsils or teeth as foci of infection. Let it be carefully noted that the dental profession was not false to the trust that was, from its very nature, theirs to warn the medical profession. As early as 1881 we find dentists writing on the subject; namely, L. C. Ingersoll, 1881;[5] A. Witzel, 1882;[23] W. J. Reese, 1886;[11] Louis Jack and C. N. Pierce, 1892-1895;[9] and others between 1880 and 1900. In 1901, Weston A. Price, Doctor of Dental Surgery, of Cleveland, said:[10]

"We will now turn our attention to the dentists' graveyard, root canal fillings (Figs. 4, 5, 6, 10, 11, 14), where so many cover up defective, careless work, trusting it will never come to light, and often reminding the patient that when his tooth gives trouble again it will have to be extracted. Humanity should thank God for a new light that will go into these dark places and show up what is often criminally careless or wilfully bad work in filling roots. True, it is often impossible to properly fill roots, but if all were as well filled as possible, those imperfectly filled would be only those with so small a canal or so little of it unfilled that the woes of humanity from this source would be infinitely less than they are."

In 1906 there followed an article by M. J. Schamberg,[22] then of Philadelphia. In 1908 *Items of Interest* published a paper by M. L. Rhein,[12] of New York, and made the following editorial comment on it:

"The complete removal of canal contents has been the bugaboo of dentists since dentistry began. Perhaps no single operation has been more written upon, and yet with the hundreds of methods which have been described as adequate, even today, if a man dare say that he can reach the apices of even the majority of tooth roots, not a few of his hearers will believe that he is either self-deceived or else a willful falsifier and a braggart. Yet certainly it is high time, for the honor of American dentistry, that this attitude should pass and that root canal treatment should be as skillfully (Fig. 7) and as successfully done as are other operations, for there is nothing in dental practice of so great importance. Of what advantage can it be to a patient for a practitioner to insert a perfectly matched porcelain inlay, or a perfectly occluded gold inlay, or a marvelously constructed bridge (Fig. 10), if the canals of the supporting teeth have been inefficiently cleansed and filled?"

In November, 1909, Professor I. N. Broomell[1] said, regarding the practice of insertion of large gold fillings near living pulps, and likewise of placing of gold shell-crowns without removal of the pulp (Fig. 11), as follows:

"As a result of the microscopic study of a number of cases, it is proposed to show that almost invariably the pulp tissue, and as well the enamel, dentine, and alveolo-dental membrane, are all more or less affected in various ways by such unnatural surroundings. Among the morbid effects produced are hyperemia of the pulp, dry gangrene of the pulp, calcification of the pulp tissue, sclerosis of the blood-vessels of the pulp, atrophy of the pulp, pulp nodules, secondary dentine, expansion of the dentinal tubules, with corresponding bulging of the dentinal fibers, pathologic pigmentation of the enamel and dentine, non-

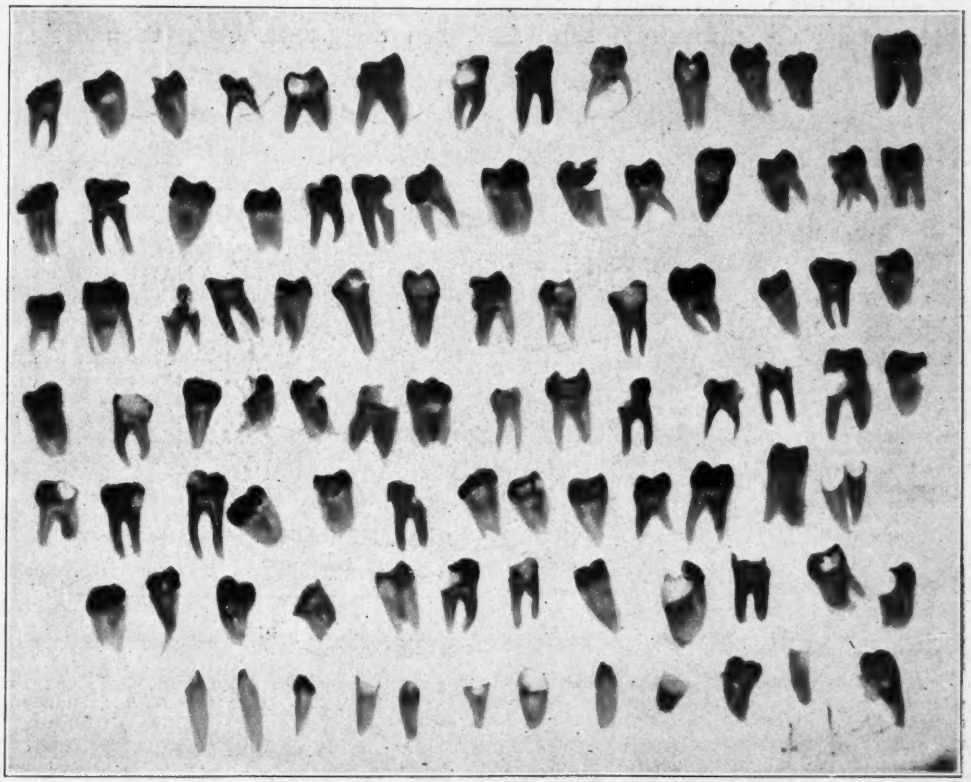


Fig. 14.—Note how the roentgenogram reveals the universal lack of proper root canal filling in teeth taken at random from the office of an extractionist in New York. Scientific root canal work in time would have saved almost all of these teeth for years of use. Compare with Figs. 3, 4, 5, 6, 7, 8 and 9. (By courtesy of Dr. W. H. Haskins.)

carious destruction of the enamel, as well as destruction by caries and perhaps a molecular change in this tissue. Any one of the foregoing may be the primary affection, after which a train of pathic conditions may ensue."

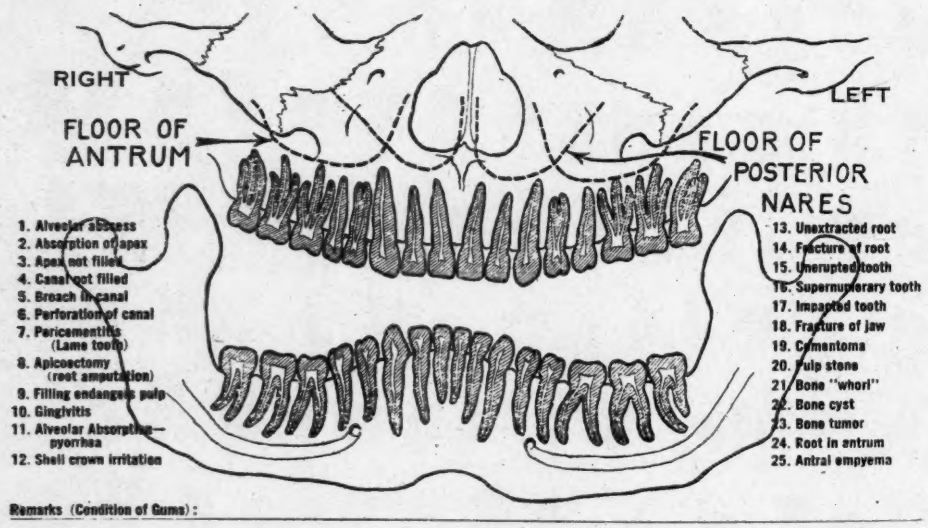
In 1910, covering the matter of mechanics and practice of bridgework, Dr. Herman E. S. Chayes[2] writes:

"At best one is brought face to face with results that are unsatisfactory, incomplete, unwholesome and unclean, etc., etc. These specimens (see Figs. 12 and 13) are not the work of all-around incompetents; authors, clinicians, professors of prosthodontia, figure among those at whose doors the existence of these specimens may be laid."

As further proof of the attitude of the progressives of the dental profession, Dr. R. Ottolengui's editorial comment on the above closed as follows:

"It is not the writer's intention to leave the impression that such evils as are here described are representative of typical American dentistry. Quite to the contrary, no one better than he knows that perfectly scientific, thoroughly aseptic, and entirely sanitary dental operations (Fig. 7) are done daily by thousands of dentists in this country. Yet it is likewise true, and pity 'tis that 'tis true, that thousands of other dentists do exactly that sort of work which Dr. Hunter so aptly terms 'septic dentistry.'

"Perhaps the great underlying reason of this may be found in the fact that neither the surgeon, the physician, the dentist, nor the patients themselves fully realize the dangers that threaten the whole body if the oral cavity be a secret storage place for 'oral sepsis.' When the people come to understand



Copyrighted. 1915, The Peck Press, New York

Fig. 15.—The Dental Chart, a 4x6 inch card in two colors for diagraming the composite x-ray findings, makes graphic and definite record for the physician and dentist and saves time. The diagram itself is in red ink and the findings are drawn in with black India ink.

that their very lives depend upon sound teeth in a clean and healthy mouth, then, and not till then, will they cheerfully pay an adequate fee for competent dental service, and in that day more dentists will practice, because they can then afford to practice thoroughly 'aseptic dentistry.'"

Nor has anything materially different been said on the subject of dying or dead pulp, root canal fillings, gold or porcelain fillings, or inlay work, crown, or bridge work. These men were pathfinders. Their colleagues have been stumbling or speeding along the way, as the custom has been and always will be. Mistakes were made, which is the point that concerns the medical profession.

The period of the dark ages in dentistry began propitiously enough when carious teeth were saved by fillings (Fig. 14). But soon mechanical dentistry became so ambitious that the dentist began to regard the loss of a tooth as the physician does the death of a patient. Their patients, even sensible men and

women, by the same token grew so vain that the loss of a tooth was a shock and forewarning of approaching dissolution.

In any roomful of adults, such as this, it is the exception if any mouth has not at least one pyorrhea pus pocket, or blind or fistulous alveolar abscess. Nor can children, with their carious and dead temporary teeth, be excepted. The radiograph visualizes the destruction caused by oral sepsis. The best dentists admit its existence and are striving by every means at their command to remove and remedy the mistaken technic of the past and by perfecting their technic to avoid it in the future, at the same time advising prevention as worth more than cure.

It is my purpose, in as few words as possible, to take up the practical matter of the scope of the report that I make, one copy of which I send to the physician for his files, and one copy of which I send to the dentist. The films are also made in duplicate, one set being kept on file, and the other sent to the physician, who may give them to the dentist for his guidance. Lately I have had a chart made (Fig. 15) on a four by six card, which I have had passed around, hoping by this graphic means to save time in making a report and to give a better guide to the dentist or physician. On this chart one can draw a composite of several films taken at different angles.

Sooner or later in doing this work, the roentgenologist is likely to be called upon by the physician to give advice as to the need of extraction, etc., and to explain dental procedures to correct the given condition. To do this, one must become well informed as to the practices of old as well as of modern dentistry. For that reason I have given you quotations from the works of the dentists themselves. It is well to read the dental journals, which are now full of this subject, in order to keep abreast of their work.

In cases of pyorrhea (Figs. 8 to 11), in connection with some serious systemic condition or incapacitating arthritis, for example, thorough extraction must be considered, first taking several cultures for autogenous vaccine treatment. In all cases, faulty long shell crown and fixed bridgework (Figs. 12 and 13) should be removed and replaced by that which can be kept clean.

A loose tooth, if there is enough sound and healthy alveolar process left to hold it (Fig. 10), must have all the lime deposits scaled off frequently. The Emetin Treatment should be considered, although it is variously criticized, as the end-amœba is only one of the one hundred and fifty bacteria present. The diet should be carefully considered along present-day findings. Meat-free and similar diets were strongly advised at one time, on the ground that the condition is systemic and metabolic, not local, and that herbivorous animals are free from pyorrhea. Many of these cases resist every treatment, and extraction is finally necessary.

In cases of blind or fistulous alveolar abscesses (Figs. 6 and 7) the procedure is even more complicated, and action should be more or less radical, depending on the patient's condition.

Too many root canals were never emptied or filled. Canals filled with so-called antiseptic cotton do not show in the radiograph. They should be condemned and the filling removed in all cases. Paraffin fillings do not show in a radiograph, but if there is an apical lesion the canal should be emptied. Gutta-

percha, either alone or combined with a metal, is more commonly used and shows well in the radiograph (Fig. 7).

There are three ways of treating an apical abscess which have supplemented the old method of emptying the canal, draining it with wisps of cotton, and injecting antiseptics until such a time as healthy granulation shall have replaced the abscess cavity. This method requires a large canal opening, and in the lower jaw, with gravity opposing, the drainage is doubtful.

The first of the newer methods, which is advocated by Dr. M. L. Rhein and claims good results, requires ionization with antiseptics. It would seem surgically possible, however, to empty the canal and, after a short period of drainage, to refill it aseptically solid to the apex, first checking the procedure by radiographing the tooth with wires in place (Fig. 7) to show that the apex was opened and emptied, and again radiographing it to determine whether the opaque filling is flush with the apex. Thus, the blind pocket in the apical canal being obliterated by the filling, healthy granulation should take place, and callus and bone repair follow (Fig. 7).

Second, when a canal cannot be emptied or filled to its apex on account of curves, or when it has been accidentally perforated, the unfilled portion may be amputated through the alveolus and the wound repacked over a long period until the usual repair takes place.

The third method, which I would emphasize, is extraction. When ever this is advisable a careful culture should be made of the tooth apex and socket on blood serum for an autogenous vaccine, for the culture if lost can never be regained. If not needed immediately some later exacerbation of the patient's condition may indicate its use.

In calling the physician's attention to these details of oral conditions, it is not my purpose to wade too deeply into the waters of dentistry, but rather to impress upon your minds that by comparatively simple procedures of dentistry urged upon the patient in time, the physician may be spared much anxiety and the patient may be greatly benefited.

BIBLIOGRAPHY.

[1]Broomell, I. N.: "The Adventitious Effect of Large Masses of Gold in Contact with Tooth Tissues." Dental Cosmos, April, 1910—389.

[2]Chayes, H. E. S.: "Empiricism in Bridgework." Items of Interest, October, 1910—754.

[3]Hartzell, Thos. B.: "Secondary Infections Having Their Primary Origin in the Oral Cavity." Jour. of All. Dental Soc., June 1914.

[4]Hunter, Wm.: "An Address on the Role of Sepsis and Antisepsis in Medicine." London Lancet, Jan., 1911. "An English Physician's Denunciation of American Dentistry." Current Lit., Aug., 1911.

[5]Ingersoll, L. C.: Ohio State Journal Dent. Sci., 1881, i, 189.

[6]MacKee, G. M.: "The X-Ray in General Dentistry." Items of General Interest, June, 1913.

[7]Mayo, C. H.: "Mouth Infections as a Source of Systemic Disease." Jour. A. M. A., Dec. 2, 1914.

[8]Pfahler, G.: "Roentgen Rays in Dentistry." Jour. A. M. A., 1909, Vol. liii, 770.

[9]Pierce, C. N.: International Journal, 1892, 1894, 1895, xiii, xv and xvi.

[10]Price, Weston A.: "Practical Progress in Dental Skiagraphy." Items of Interest, June, 1901—458.

[11]Reese, W. J.: Dental Cosmos, 1886, xxv, 550.

[12]Rhein, M. L.: Items of Interest, Nov., 1908—833.

[13]Rosenow, E. C.: "Mouth Infection as a Source of Systemic Disease." Jour. A. M. A., Dec. 2, 1914—2026.

[14]..... "Etiology of Arthritis Deformans." Jour. A. M. A., 1914, lxii, 1146.

[15]..... "Relations of and Lesions Produced by Various Forms of Streptococci with Special Reference to Arthritis." Med. Jour., iii.
[16]..... "Etiology of Acute Rheumatism, Articular and Muscular." Jour. Infect. Dis., 1914, xiv, 61.
[17]..... "Lesions Produced by Various Streptococci, Endocarditis and Rheumatism." Med. Jour., 1914, xcix, 253.
[18]..... "Studies in Endocarditis and Rheumatism." Journal-Lancet, 1914, xxxiv, 1.
[19]..... "The Production of Ulcer of the Stomach by Injection of Streptococci." Jour. A. M. A., Nov. 29, 1913.
[20]..... "Transmutations Within the Streptococcus-Pneumococcus Group." Jour. of Infect. Dis., 1914, xlv, 1.
[21]Rosenow, E. C., and Coombs, C.: "Myocardial Lesion of Rabbits Inoculated with Streptococcus Viridans." Lancet, 1913, ii, 1677.
[22]Schamberg, M.: Dental Cosmos, Jan., 1906; Dental Brief, June, 1906.
[23]Witzel, A.: Vierteljahrschrift f. Zahnheilkunde, 1882. British Jour. Den. Sci., xxv, 153.
[24]Editorial, Items of Interest, Nov., 1911—875.

Dental Disaster

ENERGETIC internists are grasping at infected tonsils and teeth with an alarming enthusiasm. No doubt these organs have been guilty of many remote infections. The tonsils seem to be quite rightly accused and convicted as primary offenders. The tonsils are wholly within the realm of medicine, and physicians need not argue tonsillar guilt with another profession. But the teeth—poor things—are being accused by physicians and defended by dentists. The dental radiograph has stepped in to promote the physician's case and to confuse the dentist. There is no doubt but that pathologists have shown that organisms, capable of remote infections, are found about the apices of diseased teeth. Consequently the physician is prepared to sacrifice the offending teeth immediately with the same assurance that he sacrifices tonsils, appendices and gall-bladders. But the dentist is not ready to see his pets sacrificed without a more thorough trial. He argues that infection about the teeth can be controlled by conscientious and painstaking dental surgery and that carelessly to extract these important organs places the individual at a distinct digestive disadvantage,

> " . . . . . , puzzles the will
> And makes us rather bear those ills we have
> Than fly to others that we know not of."
> Hamlet, Act III, Scene I.

There appears to be little doubt, and dental radiography seems to prove, that there are more infections about teeth which have been the victims of American mechanical dentistry. Also it is true that dangerous granulomas arise at the apices of injured teeth without previous dental attention. Many contributions (notably Rhein's) appear to prove that these granulomas may be completely healed by proper aseptic root-fillings. Is it necessary then to sacrifice teeth and force the patient to bridges and plates? It spoils two good teeth to anchor a bridge, and unless the anchor teeth are aseptically prepared the patient has two potential sources of infection where one previously existed. Plates may be uncomfortable, distort taste impressions and require unceasing attention to cleanliness. Bridges and plates, therefore, interfere with digestion and consequently the health and happiness of the patient. The human race as it is

constituted today cannot hope to avoid the route of the Dinosaurus if the teeth are to be continually sacrificed.

The teeth must be preserved and used for their original purpose of mastication or they will contrive to make trouble. Perhaps the increase in soft prepared foods for children prevents the development of sound teeth. It requires exercise to develop muscle and study to develop brains and, likewise, mastication to develop healthy teeth. Otherwise muscles become flabby, brains stagnate, and teeth lack resistance and become soft, inviting infection. Again, dentists have not generally appreciated surgical cleanliness—asepsis. They are where surgery was twenty-five years ago in the antiseptic stage. Dentists still seal antiseptic preparations in root canals to eradicate infections. This is contrary to accepted surgical authority.

It would seem that it is necessary to inject much which is known in surgical pathology into dental teaching and also teach dentists the principles of surgical asepsis. Failure along these lines has forced physicians to advise the sacrifice of teeth. The conflict is still waging.—*Dr. Edward H. Skinner, Interstate Medical Journal.*

Relation of the Teeth to Tuberculosis

AN examination of oral conditions in 297 cases of tuberculosis in a sanatorium showed: Bad condition of the mouth in fifty-one per cent; bad condition of the teeth in forty per cent; bad condition of the gums in fifty-one per cent, and pyorrhea in thirty-five per cent. It is a question whether the tuberculous disease and mixed infection in these patients arose through the condition of their teeth and gums or whether their tuberculous condition affected the teeth and gums secondarily. It is assumed, at any rate, that a bad condition of the teeth and gums affords a good medium for the growth of the tubercle bacillus, which has often been found in teeth containing cavities. Sore teeth and tender gums may, moreover, be the cause of insufficient and ineffectual mastication. The author establishes a contrast between the general results obtained in the female and male patients in the sanatorium, the former being much more careful and obedient in the care of their teeth and gums than the latter. The male patients, placed under the same solarium treatment as the female, have not shown the same percentage of good results. Freudenberger is convinced that the care and time spent by female patients in keeping their mouths clean has assisted materially in bringing about a marked improvement in their general condition. The tuberculous patient with clean teeth and good gums has a better chance of quiescence or arrest of the disease than one in whom conditions in these respects are bad.—*H. Freudenberger, Lancet-Clinic.*

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter, payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 1016 East Armour Boulevard, Kansas City, Mo. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

Illustrations—Such halftones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

Advertisements—Objectionable advertisements will not be accepted for publication in this journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

Change of Address—The publishers should be advised of change of subscriber's address about fifteen days before date of issue, with both new and old addresses given.

Nonreceipt of Copies—Complaints for nonreceipt of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

EDITORIALS

Dental Laws and the State Board

As those engaged in the practice of dentistry in America increased in number, various laws in different states were passed to regulate the practice of that profession. The enactment of these laws was also influenced more or less by the advent of the dental college and the raising of the educational requirements by the National Association of Dental Faculties. The result of these efforts at regulation has been the establishment of state boards for the purpose of examining those who intend to practice dentistry. That the present methods of these boards are not satisfactory is proved by the many efforts that are being made to change the present laws and to place the state board examinations on a more uniform basis. Regardless of how efficient or how inadequate a law may be, there are always some persons to oppose a change. There is no question that the public should be concerned in the regulation of the practice of dentistry, as the laws are made for its protection, but practically all efforts for

the enactment of medical or dental laws are promoted by the profession and not by the public. There has also been more or less disagreement between various organizations, and in some instances between state boards and dental colleges, which has caused needless conflicting laws in different states.

The medical profession has advocated the creation of a national examining board, which shall pass on the qualifications of every graduate in medicine, regardless of the state in which a graduate expects to locate. While this would probably be the ideal plan, a difficulty arises on account of the provisions of state laws, which give each state certain sovereign rights, especially in regard to police powers. If Congress would form a department—known, we will say, as the Department of Public Health—which would be governed by a secretary the same as are the war, navy, and treasury departments, and medical and dental examinations be taken out of the hands of the states, and placed under the supervision of this department, matters would be greatly simplified. It is, however, needless to say there would be a great deal of opposition to such a plan, as it would be considered a centralization of power, would eliminate a large number of state boards, and cause the abolishment of offices occupied by certain men. It is rather unfair to expect a student who has been graduated from a medical or dental college to pass the state board examination in whatever state he expects to practice. If he is qualified to practice in one part of the United States, he should be qualified to practice in another. There seems to be no sound argument against this, and the only opposition comes from the resident members of the profession in a state. We have often heard it stated both by medical and dental men that they did not intend to have their locality overrun by men coming from other states to practice. It is known that in certain states of the United States it is practically impossible to pass the examination before the state board unless one is "a native son," or a graduate of a certain school located in the state in question. In other words, some state boards have assumed a protective power whereby they intend to protect the dental profession of the state from competition, regardless of the ability of the dentists in that state, or of the proficiency of the man who desires to locate there. This is a very unfair and narrow view but nevertheless that view prevails in some sections.

In regard to the status of orthodontia in respect to the state boards, we find a very undesirable condition existing. For example, a man may be qualified to practice orthodontia, having obtained that qualification either by years of practice or by a special line of training, and, if he desires to locate in another state, he is compelled to pass all the examinations required of a man who intends to practice general dentistry. It is desirable to have a certain examination for the man who is to specialize in orthodontia, and that examination should be of a character to determine his fitness for that specialty. It should be more exacting along certain lines than the examination required for the man who is to do general dentistry. It should also be compulsory for a man who intends to give up general practice and engage in orthodontia to present a recommendation or pass an examination to prove he is qualified to practice orthodontia as a specialty. Unfortunately, as conditions exist today, a man may be a failure in dentistry and decide over night that he will engage in orthodontia, and the

public has no way of protecting itself. We have known of a few instances of men who qualified themselves to practice orthodontia, and decided to locate in states where they were not registered to practice dentistry, and, because they would compete with some man who had influence in a state and with the state board, they had considerable difficulty in obtaining a license. In one case a man was informed that if he would change the locality he had in view and go to another town, he would have no difficulty in passing the state board. These conditions point to the need of a more centralized plan of medical and dental examinations, and emphasize the necessity of having a special examination for those intending to engage in the practice of orthodontia, and of making every man pass that examination, whether he be native born or a foreigner. Just how this proposition will be worked out will be a question of the future, and it is a question that demands a logical solution.

The Department of Dental and Oral Radiography

WITH the first issue of the *International Journal of Orthodontia,* we announced that the Journal would be devoted to the advancement of the science of orthodontia and the correlated subjects. We have tried to adhere to that policy both in the publication of articles and in the editorial columns. Realizing the advantage to the dental profession of a department devoted exclusively to the x-ray and its application in the various branches of practice, and believing as we do that radiography is closely related to orthodontia, we have inaugurated with this issue a Department of Dental and Oral Radiography, under the direct editorship of Dr. James David McCoy, of Los Angeles, Professor of Orthodontia and Radiography in the College of Dentistry of the University of Southern California.

Every dental practitioner knows that the x-ray is a valuable asset to dental practice, but comparatively few realize the extent of its usefulness, or to put it more definitely, few realize that this agent is absolutely indispensable if the dentist fulfills his professional obligations.

Doubtless many will consider such a statement as being ultra radical, and if so, they are at liberty to offer proof to the contrary. In the meantime, it will be the policy of this Journal to assume that the x-ray is indispensable to the dentist who fulfills his professional obligations, to encourage its more universal adoption by dentists as a regular part of office routine, and through its pages instruct those who are interested.

Those who are familiar with the development of orthodontia within the last ten years know that radiography has been an invaluable adjunct to the practice of this specialty. It was the orthodontist who first used the radiograph in dentistry for the location of missing and supernumerary teeth. We can well remember when a radiograph of the teeth and jaws was considered a scientific curiosity. After having successfully employed the radiograph in the diagnosis of missing and supernumerary teeth, its field of usefulness was then extended to the study of the movement of teeth and much of our present knowledge of the tissue changes during tooth movement has been obtained by radiographing

the teeth before and after movement, thereby proving development of bone, as the result of tooth movement, to be an entirely different process from what we had formerly thought. It was also proven by radiographs made by Dr. Ketcham that in the mesial and distal movement of permanent molars the teeth erupting posterior to the ones that had been moved succeeded in erupting in their proper position. As the result of radiographic studies made by Drs. Ottolengui, Kemple and others, it has been shown that a large number of permanent teeth are absorbed prior to, and in some instances, during orthodontic treatment. The causes of the absorption of the roots of teeth are not fully understood, and, if they are ever known, it will undoubtedly be through the aid of the radiograph. Another disputed question in the treatment of malocclusion is the change which occurs in the temporomandibular articulation during the treatment of mesioclusion and distoclusion. If this question is ever fully settled, it will be as a result of the knowledge gained through the radiograph.

It is the intention of the editor that the articles appearing in this department shall be instructive both to the beginner in radiography and to those who may no longer be classed as novices. With this end in view, articles of an elementary character will appear along with case histories, and other articles involving the practical application of the x-ray in the general practice of dentistry, in orthodontia, oral surgery, etc.

The man who enters dentistry today assumes a great responsibility and an obligation which is no less than that of the practitioner of medicine. Even though the field of our endeavors is limited, the teeth and their associated structures are now recognized as among the most important of the body from the standpoint of health maintenance. For years, scientific dentists have held that many serious bodily ailments were traceable to dental origin, but only within recent years has the full significance of their claims been appreciated by the medical profession and the public, in which pioneering work the x-ray has played an important role.

Only a short time ago one of the leaders in medical science made the statement that the next great step in preventative medicine would have to come from the dental profession. The question naturally arises, are we as a profession going to make good? If so, we must take advantage of every facility which will increase our efficiency among which the x-ray stands paramount.